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ABSTRACT

This curriculum guide contains 14 units of instruction for a course in anatomy and physiology for surgical technology students. The units cover the following topics: (1) organization of the body; (2) cells, tissues, and membranes; (3) integumentary system; (4) skeletal system; (5) muscular system; (6) nervous system; (7) special sense organs; (8) digestive system; (9) circulatory system; (10) lymphatic system; (11) respiratory system; (12) reproductive system; (13) urinary system; and (14) endocrine system. Each of the units contain some or all of the following basic components of a unit of instruction: objective sheet, suggested activities for the teacher, answers to assignment sheets, answers to written test, written test, unit evaluation form, teacher supplements, transparency masters, information sheet, student supplements, assignment sheets, and job sheets. All the unit components focus on measurable and observable learning outcomes, and are planned to be used in more than one lesson or class period of instruction. In addition, this teacher edition includes suggestions for using the materials, and an instructional and task analysis. Contains seven references. (KC)

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Anatomy and Physiology

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Revised
Teacher Edition

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Anatomy and Physiology
Revised Edition

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Anatomy and Physiology
Revised Edition

Teacher Edition

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Foreword

The Mid-America Vocational Curriculum Consortium (MAVCC) was organized for the purpose of developing mutually-needed instructional materials for our eleven member states. Priorities for developing instructional materials are determined annually. This year the revisions of *Anatomy and Physiology* and the *Surgical Technology* series were identified.

Anatomy and Physiology, Revised Edition, is designed not only for student use, but to assist teachers in improving instruction. Written tests have been developed for use as a pre-test and post-test to measure competency gains. Special attention should be given to the teacher suggestions in each unit of instruction. These suggestions present ways to increase reinforcement of academic and workplace basic skills. By reinforcing these skills, the instructor will assist students in improving their employability skills.

As you use these instructional materials, we hope you find they contribute to the quality of your program. Every effort has been made to make these materials readable and by all means useable. You, as an instructor, will need to develop instructional strategies for localizing, individualizing, and supplementing the instructional materials. Most of all, you need to motivate the students who use the materials.

As always, MAVCC appreciates hearing from people who use our publications. Please write or call MAVCC and share your opinions about *Anatomy and Physiology, Revised Edition*. Tell us what you liked and/or what you think needs to be changed. We want to hear from you.

Mervin Birdwell, Chairman
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Mid-America Vocational
Curriculum Consortium

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The contents of this publication were originally planned and reviewed by the following members of the Mid-America Vocational Curriculum Consortium surgical technology committee:

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Gratitude is expressed to the employees of the Graphics Division of the Oklahoma Department of Vocational and Technical Education for the typing, artwork, and printing of this text.

Finally, thanks are extended to **Mary Kellum**, Curriculum Specialist, for her assistance with editing and the innumerable tasks involved in completing this text.

Use of Introductory Materials

Introductory materials are included in the teacher guide only and contain useful information to assist administrators and teachers in planning for instruction.

In addition to the general information such as the table of contents, foreword, and acknowledgements page, information is included on the following:

1. **Use of this publication**—Explains the components of a unit of instruction and how they should be used as part of the teaching/ learning process.
2. **Instructional/task analysis**—Provides a quick review of contents of the publication; identifies cognitive (knowledge) skills and psychomotor (doing) skills addressed in each unit of instruction.
3. **Reference list**—Provides a comprehensive list of resources used in the development of this publication.

As you use these materials, it is hoped that they will provide useful information to meet a variety of needs.

Use of This Publication

Instructional units

Anatomy and Physiology contains fourteen units of instruction. Each instructional unit in a teacher guide includes some or all of the following basic components of a unit of instruction: objective sheet, suggested activities for the teacher, answers to assignment sheets, answers to written test, written test, unit evaluation form, teacher supplements, transparency masters, information sheet, assignment sheets, student supplements, and job sheets.

All of the unit components focus on measurable and observable learning outcomes. Teachers are encouraged to supplement, personalize, localize, and motivate with these materials in order to develop a complete teaching/learning process.

Units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the teacher will help to determine the following:

- Amount of materials that can be covered in each class period.
- Skills that must be demonstrated.
- Amount of class time needed for demonstrations.
- Amount of time needed for student practice.
- Supplementary materials, including print and nonprint media and equipment and supplies, that must be ordered.
- Resource people who must be contacted.

Objective sheet (Color code: White)

Each unit of instruction is based on performance objectives which state the goals for successful completion of the course. These performance objectives are stated in two forms: unit objectives which state the expected performance of each student after completion of the unit of instruction, and specific objectives which state what the student must do to reach the unit objective.

The objectives should be provided for students and stressed throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods. Teachers should prepare for each unit by deciding how each objective can best be taught.

Teachers should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When objectives are added, the teacher should remember to supply the needed information, assignment and/or job sheets, and criterion test items.

Suggested activities (Color code: Pink)

This component is included only in the teacher guide. The suggested activities assist teachers during the preparation stage of the teaching/learning process by providing an instructional plan, teaching suggestions, and a list of supplemental resources. Ways to integrate academic and workplace skills have been included in the teacher suggestions, and skill areas have been noted in bold. The teacher should read the suggested activities before teaching the units and decide how each objective can best be taught. Time should also be allowed to obtain supplemental materials, prepare audiovisual materials, and contact outside resources. Duties of the teacher will vary according to the particular unit.

References used in the development of each unit are listed in the suggested-activities section, along with suggested supplemental resources that may be used to teach the unit. These materials can be used by the teacher to supplement her or his knowledge of the subject area or to help students with particular interests or objectives in the area covered.

Instructions for evaluating student performance on the job sheets are also included in the suggested-activities section. Teachers should select and discuss with students the rating scale that will be used.

Assignment, student supplement, and written test answers (Color code: Pink)

Answers to assignment sheets, student supplements, and written tests are designed to assist the teacher in evaluation of student performances.

Written test (Color code: Yellow)

This component provides criterion-referenced evaluation of every cognitive objective listed in the unit of instruction. The test appears in the teacher guide only, but duplication is permitted for student use. If objectives have been added, deleted, or modified, appropriate changes should be made on the written test. It is recommended that the tests be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered. A selection of test items from the units covered may be used for final tests at the end of each term if desired.

Unit evaluation form (Color code: White)

This sheet provides teachers with a record of each students performance on a unit of instruction. It includes space for assignment sheet ratings, job sheet ratings, written test scores, and teacher comments. The unit evaluation form is included in the teacher guide only, but may be duplicated.

Use of This Publication

Teacher supplements (Color code: White)

This component is included only in the teacher guide. Teacher supplements are optional materials for the teacher to use. They have three purposes: to provide the teacher with higher level materials to stretch the advanced student, with remedial information or practice to assist the less-advanced student, and with state-of-the-art information in which the teacher may not have background or with information that is not readily available in other books. Some teacher supplements may be duplicated for student use and are marked accordingly.

Transparency masters (Color code: White)

Transparencies are included in the teacher guide only and are used to direct the students' attention to the topic of discussion. They may provide illustrations, charts, schematics, or additional information needed to clarify and reinforce objectives included in the unit of instruction.

Information sheet (Color code: Green)

The information sheet provides the content essential for meeting the cognitive (knowledge) objectives of the unit. Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. Students should read the information sheet before the information is discussed in class. Space is provided in margins for students and teachers to add notes that supplement, localize, personalize, or provide information for the teaching of each objective.

Student supplements (Color code: White)

Student supplements are included in the student manual. The information presented in a student supplement may consist of tables, charts, written information, forms, or other information students will need in order to complete one or more of the assignment and/or job sheets. Students are not directly tested over the information presented in a supplement; however, their ability to apply this information may be evaluated in the completion of assignment sheets or job sheets.

Assignment sheets (Color code: Tan)

Assignment sheets provide students with pencil and paper activities that give students the opportunity to make practical application of the knowledge in the information sheet. Criteria are provided to objectively evaluate student performance.

Job sheets (Color code: Blue)

The job sheets provide criteria to objectively evaluate student performance, a list of required equipment and materials, and a step-by-step procedure for performing a psychomotor skill. The teacher should discuss the equipment and materials available in the classroom and/or laboratory and demonstrate the procedure prior to having students practice procedure. When a student is ready to be evaluated, the teacher should follow instructions for evaluating student performance which may be found in the teacher guide.

Job sheets are an important segment of each unit. Job sheets provide potential employers with a picture of the skills being taught during training and the performances that might reasonably be expected from an individual who has had this training.

Disseminating material

Material may be given out a unit or page at a time to keep the material before the student always new. Some teachers ask students to furnish a three-ring binder or folder for the current unit of study. This is convenient for students taking the material home to study. Upon completion, each unit is then placed in a larger binder. Some teachers prefer to store the material by unit in filing cabinets or boxes until needed.

For best results, provide student materials for each student. Student manuals contain objective sheets, information sheets, student supplements, assignment sheets, and job sheets. Students should be allowed to take their materials home at the end of the course.

Anatomy and Physiology
Revised Edition

Instructional/Task Analysis

Related Information: What the Student Should Know	**Application: What the Student Should Be Able to Do**
Unit 1: Organization of the Body	
1. Terms and definitions	
2. Difference between anatomy and physiology	
3. Anatomical position	
4. Body planes	
5. Directional terms	
6. Locating terms	
7. Body positions	
8. Three general regions of the body	
9. Body cavities and their contents	
10. Quadrants of the abdominopelvic cavity	
11. Organs in the abdominopelvic cavity	
12. Nine abdominal regions	
13. Major types of body structures	
14. Single ultimate goal of an organism	
15. Three basic activities for life of an organism	
16. Composition of the human body	
17. Descriptions of major organ systems of the human body	
18. Organs and structures in the major organ systems	

Related Information: What the Student Should Know

Application: What the Student Should Be Able to Do

Unit 2: Cells, Tissues, and Membranes

1. Terms and definitions
2. Compounds in protoplasm
3. Principal types of protoplasm
4. Major parts of a cell
5. Characteristics of the parts of a cell
6. Functions of a cell
7. Active and passive transport of material through a cell membrane
8. Types of active transport
9. Types of passive transport
10. Types of solutions
11. Types of cellular reproduction
12. Basic types of tissues
13. Characteristics of epithelium
14. Classifying epithelium
15. Types of connective tissue
16. Types of muscle tissue
17. Types of nerve tissue
18. Main types of membranes

19. Demonstrate the transport movement of materials

Unit 3: Integumentary System

1. Terms and definitions
2. Characteristics of the skin
3. Two main layers of the skin

Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
4. Layers of the epidermis	
5. Layers of the dermis	
6. Accessory appendages of the skin	
7. Functions of the skin	
8. Disorders and abnormalities of the skin	
Unit 4: Skeletal System	
1. Terms and definitions	
2. Functions of the skeletal system	
3. Specific types of bones	
4. Materials which make up the composition of bones	
5. Types of bone markings	
6. Structures of a long bone	
7. Components making up the structure of bones	
8. Characteristics of bone marrow	
9. Two parts of the human skeleton	
10. Bones of the skull	
11. Characteristics of the hyoid bone	
12. Regions and bones of the vertebral column	
13. Characteristics of the ribs and the sternum	
14. Bones of the appendicular skeleton	
15. Functions of the articular system	
16. Components of articular structure	
17. Articular classifications	

Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
18. Types of movable joints	
19. Types of articular movements	
20. Main cartilages and ligaments of the knee joint	
21. Injury to the knee joint	

Unit 5: Muscular System

Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
1. Terms and definitions	
2. Classifications of muscle tissue	
3. Major functions of muscles	
4. Muscle attachments	
5. Parts of a muscle	
6. Functional characteristics of muscle tissue	
7. Types of muscles	
8. Action of the skeletal muscles	
9. Muscle groups and their functions	
10. Criteria for remembering names of muscles	
11. Principal skeletal muscles	
12. Functions of principal skeletal muscles	

Unit 6: Nervous System

Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
1. Terms and definitions	
2. Functions of the nervous system	
3. Parts of a typical neuron	
4. Types of neurons	
5. Transmission of nerve signals	

	Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
6.	Components of a reflex arc	
7.	Characteristics of a nerve fiber	
8.	Parts of a nerve fiber	
9.	Mechanism of regeneration of peripheral nerves	
10.	Two main divisions of nervous system	
11.	Constituents found in the spinal canal	
12.	Characteristics of the spinal cord	
13.	Components of cerebrospinal fluid	
14.	Purpose of cerebrospinal fluid	
15.	Layers of the meninges	
16.	Parts of the brain	
17.	Lobes of the cerebral hemisphere	
18.	Functions of parts of the brain	
19.	Functional areas of the brain	
20.	Fissures of the brain	
21.	Characteristics of the ventricles of the brain	
22.	Blood supply to the brain	
23.	Names and numbers of pairs of spinal nerves	
24.	Plexuses of the central nervous system	
25.	Names, numbers, and specific functions of cranial nerves	
26.	Subdivisions of autonomic nervous system	

Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
Unit 7: Special Sense Organs	
1. Terms and definitions	
2. Parts of the sensory mechanism	
3. Five special senses and organs	
4. Layers of the eyeball	
5. Humors of the eyeball	
6. Extrinsic and intrinsic eye muscles	
7. Accessory structures of the eye	
8. Parts of the ear	
9. Types of conduction used for hearing	
10. Sense of smell	
11. Sense of taste	
12. Sense of touch and pain	
Unit 8: Digestive System	
1. Terms and definitions	
2. Description of the alimentary canal	
3. Organs which form the alimentary canal	
4. Functions of the digestive system	
5. Anatomy of the abdominopelvic cavity	
6. Functions of the peritoneum	
7. Coats composing the walls of the alimentary canal	
8. Functions of the organs of the alimentary canal	
9. The mouth	

	Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
10.	Types of teeth	
11.	Three portions of a tooth	
12.	The salivary glands	
13.	The pharynx	
14.	The esophagus	
15.	The stomach	
16.	Openings of the stomach	
17.	Curvatures of the stomach	
18.	Parts of the stomach	
19.	Blood and nerve supply to the stomach	
20.	Small and large intestines	
21.	Portions of the small intestine	
22.	Divisions of the large intestine	
23.	Sections and flexures of the colon	
24.	Blood supply to the large intestine	
25.	The liver	
26.	Functions of the liver	
27.	Ducts of the liver	
28.	Ligaments of the liver	
29.	Lobes of the liver	
30.	Blood supply to the liver	
31.	The gallbladder	
32.	The pancreas	

Related Information: What the Student Should Know	**Application: What the Student Should Be Able to Do**

Unit 9. Circulatory System

1. Terms and definitions
2. Functions of the circulatory system
3. Organs of the circulatory system
4. Constituents of blood
5. Characteristics of red blood cells
6. Characteristics of white blood cells
7. Characteristics of platelets
8. Physical characteristics of blood
9. Composition of blood plasma
10. The Rh factor
11. Four blood groups
12. Blood clotting mechanism
13. Structure of the heart
14. Covering of the heart
15. Layers of the heart
16. Chambers of the heart
17. Valves of the heart
18. Orifices of the heart
19. Circulation of blood through the heart
20. Blood supply of the heart
21. Nerve supply of the heart
22. Characteristics of arteries
23. Characteristics of veins
24. Characteristics of capillaries

	Related Information: What the Student Should Know	Application: What the Student Should Be Able to Do
25.	Circulation of blood through vessels	
26.	Types of circulation	
27.	Major components of pulmonary circulation	
28.	Parts of the aorta	
29.	Major arteries of systemic circulation	
30.	Major veins of systemic circulation	
31.	Portal circulation	
	Unit 10: Lymphatic System	
1.	Terms and definitions	
2.	Functions of the lymphatic system	
3.	Structures of the lymphatic system	
4.	Characteristics of lymph	
5.	Movement of lymph	
6.	Characteristics of lymph capillaries	
7.	Characteristics of lymph vessels	
8.	Major lymph ducts	
9.	Characteristics of lymph nodes and nodules	
10.	Major lymph nodes	
11.	Types of tonsils	
12.	Characteristics of the thymus	
13.	Characteristics and functions of the spleen	

Related Information: What the Student Should Know	**Application: What the Student Should Be Able to Do**

Unit 11: Respiratory System

1. Terms and definitions
2. Purpose of the respiratory system
3. Characteristics of respiration and breathing
4. Parts of the respiratory system
5. Characteristics of the nose
6. Functions of the nose
7. Accessory structures of the nose
8. The pharynx
9. Divisions of the pharynx
10. The larynx
11. The trachea
12. The bronchi
13. The lungs
14. Lobes of the lungs
15. Functions of the lungs
16. The pleura
17. Divisions of the thorax
18. Muscles which change the size of the thorax
19. Signs and symptoms of pulmonary impairment and breathing disturbances

Related Information: What the Student Should Know	**Application: What the Student Should Be Able to Do**

Unit 12: Reproductive System

1. Terms and definitions
2. Functions of the reproductive system
3. Development of the human reproductive organs
4. Secondary sex characteristics
5. Primary and accessory male reproductive glands
6. Seminal ducts
7. Supporting structures of the male reproductive system
8. Seminal fluid
9. Characteristics of the female reproductive system
10. Female reproductive organs
11. Characteristics of the uterus
12. Functions of the uterus
13. Parts of the uterus
14. Normal and abnormal positioning of the uterus
15. Layers of the uterine walls
16. Ligaments supporting the uterus
17. Characteristics of the uterine tubes
18. Functions of the uterine tubes
19. Characteristics of the ovaries
20. Functions of the ovaries
21. Characteristics of the vagina

	Related Information: What the Student Should Know	**Application: What the Student Should Be Able to Do**
22.	Functions of the vagina	
23.	Female external genitalia	
24.	The breasts	
25.	Phases of the menstrual cycle	
26.	Characteristics of menstruation	
27.	Menstrual irregularities	
28.	Characteristics of pregnancy	
	Unit 13: Urinary System	
1.	Terms and definitions	
2.	Functions of the urinary system	
3.	Organs of the urinary system	
4.	Size, shape, and location of the kidneys	
5.	Structure of the kidneys	
6.	Functions of the kidneys	
7.	Formation of calculi in the kidneys	
8.	Blood and nerve supplies of the kidneys	
9.	Characteristics and functions of the ureters	
10.	Characteristics and functions of the urinary bladder	
11.	Characteristics and functions of the male and female urethra	
12.	Physical characteristics of urine	
13.	Normal and abnormal constituents of urine	
14.	Process of expelling urine	

Related Information: What the Student Should Know	**Application: What the Student Should Be Able to Do**

Unit 14: Endocrine System

1. Terms and definitions
2. Function of the endocrine glands
3. Physiological processes affected by hormones
4. Principal endocrine glands
5. Pituitary gland
6. Hormones of the pituitary gland according to location
7. Functions of the hormones of the pituitary gland
8. The thyroid gland
9. The parathyroid gland
10. The adrenal glands
11. Principal hormones of the adrenal glands
12. The gonads
13. The Islands of Langerhans
14. Other structures with endocrine functions
15. Disorders of the endocrine glands

Anatomy and Physiology
Revised Edition

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Organization of the Body
Unit 1

Objective Sheet

Unit Objective

After completing this unit, the student should be able to distinguish between anatomy and physiology, identify body planes and quadrants, and match major organ systems with their descriptions and their organs. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to organization of the body with their correct definitions.
2. Distinguish between anatomy and physiology.
3. Define anatomical position.
4. Identify body planes.
5. Match directional terms with the correct descriptions.
6. Match locating terms with the correct descriptions.
7. Match body positions with the correct descriptions.
8. List the three general regions of the body.
9. Complete a chart outlining the body cavities and their contents.
10. Identify the quadrants of the abdominopelvic cavity.
11. Classify organs in the abdominopelvic cavity according to their quadrant locations.
12. Identify the nine abdominal regions.
13. Arrange in order the major types of body structures from simplest to most complex.
14. State the single ultimate goal of an organism.

Objective Sheet

15. List the three basic activities for life of an organism.
16. Complete statements concerning the composition of the human body.
17. Match the major organ systems of the human body with the correct descriptions.
18. Match the major organ systems with their correct organs and structures.

Organization of the Body
Unit 1

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Anatomical Position (Objective 3)
   TM 2—Body Planes (Objective 4)
   TM 3—Directions (Objective 5)
   TM 4—Body Cavities (Objective 9)
   TM 5—Quadrants of the Abdominopelvic Cavity (Objective 10)
   TM 6—Regions of the Abdomen (Objective 12)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

Suggested Activities

Evaluation

11. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

12. Make copies of the written test. Add or modify test items as needed.

13. Give written test.

14. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

15. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Have students identify the quadrants, cavities, and regions of the body using a chart, diagram, or model torso available in the classroom.

2. Show available films dealing with the organization of the body and/or the interrelationship between the body's various organ systems.

3. Discuss the integrated functions of the body's organ systems in accomplishing basic activities such as movement or reproduction.

4. Encourage participation in student organizations to develop students' **self-esteem, leadership skills, interpersonal relations**, and **motivation/goal setting skills**.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.

2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.

3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.

4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Audiotapes

   a. *Getting Started* (must be completed before other tapes in the series)

   b. *General Medical Terms*

   Part of the *Medical Terminology Made Easy* Series of audiotapes available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

2. Videotape—*Landscapes and Interiors*, part of *The Living Body* Series available from:

   Films for the Humanities and Sciences
   P.O. Box 2053
   Princeton, NJ 08543-2053
   800-257-5126 or 609-452-1128

3. Anatomy charts and models are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
   P.O. Box 21207
   Waco, TX 76702-1207
   800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
   3823 Leavenworth Street
   Omaha, NB 68105
   800-228-7117

4. Anatomy tutorial software programs

   a. *Bodyworks: An Adventure in Anatomy* software program. Comprehensive computer graphics to study specific areas from head to toe including skeletal, muscular, nervous, digestive, cardiovascular, reproductive, and other major systems. System requirements: IBM PC or Compatible, 512K memory, MS-DOS 2.2 or above. Hard disk drive (uses 2.5 Mb), VGA or EGA displays 5.25" (1.2 Mb) or 3.5" (720K) disk drive. (Optional) Microsoft Mouse or compatible. Software available from:

Suggested Activities

Software Marketing Corporation
9831 South 51st Street, C-113
Phoenix, AR 85004
800-545-6626

b. *Graphic Human Anatomy and Physiology Tutor*, 11 part series covering all systems of the human body. Requirements: IBM. 384K, two disk drives, 5-1/4" or one drive, 3-1/2", an RGB color monitor with EGA interface card if preferred, or a monochrome or CGA interface. Color will be produced only with EGA interface.

c. *Biology Flash Series*, 10 part series of intelligent flash card programs using a game format for vocabulary study. Requirements: IBM - DOS 2.0 or later and CGA or compatible graphics.

d. *Understanding Human Physiology*, 4 part series covering homeostasis, cardiovascular function, membrane potentials, and exercise physiology. Requirements: IBM. Two disk drives, 5-1/4", are required, or one drive, 3-1/2". An RGB monitor with CGA interface card is preferred, or a monochrome graphic interface.

e. *Body Language: Study of Human Anatomy*, 7 part series consisting of drills for identifying and naming anatomical structures. For Apple or IBM. Requirements: IBM - Color graphics adapter.

b-e are available from:

Projected Learning Programs Inc.
P.O. Box 3008
Paradise, CA 95967-3008
800-248-0757

Organization of the Body
Unit 1

Answers to Written Test

1. a. 2
   b. 9
   c. 3
   d. 8
   e. 4
   f. 10
   g. 5
   h. 6

2. a

3. The body standing erect, with arms at the side and the palms facing forward

4. a. Transverse or horizontal plane
   b. Sagittal plane
   c. Median or midline plane
   d. Coronal or frontal plane

5. a. 4
   b. 9
   c. 10
   d. 8
   e. 3
   f. 1
   g. 5
   h. 6
   i. 2

6. a. 5
   b. 2
   c. 6
   d. 3
   e. 1

7. a. 4
   b. 3
   c. 1
   d. 2

8. a. Head
   b. Trunk
   c. Limbs

9. a. (1) Cranial cavity
      (2) Spinal cord
   b. (1a) Pleural
      (1b) Heart
      (2a) Abdominal
      (2b) Urinary bladder

Answers to Written Test

10. a. Right upper quadrant
    b. Left upper quadrant
    c. Right lower quadrant
    d. Left lower quadrant

11. a. 1
    b. 2
    c. 2
    d. 3
    e. 3
    f. 1
    g. 3
    h. 1
    i. 1
    j. 4

12. a. Right hypochondriac region
    b. Epigastric region
    c. Left hypochondriac region
    d. Right lumbar region
    e. Umbilical region
    f. Left lumbar region
    g. Right iliac region
    h. Hypogastric region
    i. Left iliac region

13. a. 4
    b. 1
    c. 3
    d. 5
    e. 2

14. Survival

15. a. Movement
    b. Metabolism
    c. Reproduction

16. a. Solids
    b. Two
    c. Extracellular

17. a. 5
    b. 9
    c. 4
    d. 1
    e. 11
    f. 3
    g. 8
    h. 10
    i. 6

18. a. 8
    b. 6
    c. 3
    d. 5
    e. 10
    f. 9
    g. 7
    h. 4
    i. 2

Organization of the Body
Unit 1

Written Test

Name ________________________________ Score ______________

1. Match the terms on the right with the correct definitions.

_____a. Imaginary lines or cuts separating the body into specific areas

_____b. Lying down

_____c. A hollowed out space

_____d. Any of the four quarters into which something is divided by two real or imaginary lines that intersect each other at right (90°) angles

_____e. The simplest form of living matter that is capable of maintaining life and reproducing itself

_____f. Group of similar cells arranged with intercellular substance between them specialized to perform a particular function

_____g. Several types of tissues arranged in an organized manner to perform a particular function

_____h. Group of organ systems which make up an integrated whole person or animal

1. Bisymmetry
2. Body planes
3. Cavity
4. Cell
5. Organ
6. Organism
7. Organ system
8. Quadrant
9. Recumbent
10. Tissue

2. Distinguish between anatomy and physiology by placing an "X" next to the definition of anatomy.

_____a. Scientific study of the structure of an organism which describes the size, shape, construction, and relative positions of the organs in the body

_____b. Scientific study of the functions of an organism which describes how the organs work independently and in relation to the whole organism

Written Test

3. Define anatomical position.

____

____

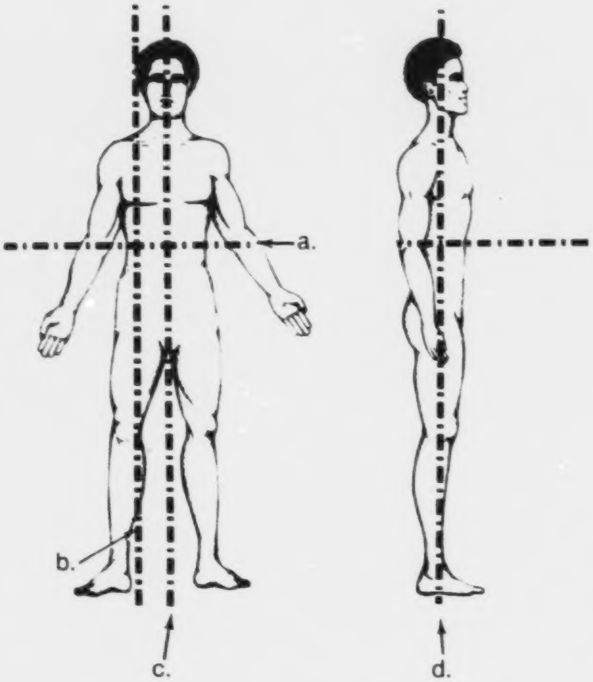
4. Identify the body planes below.

a. ____

b. ____

c. ____

d. ____



Written Test

5. Match the directional terms on the right with the correct descriptions.

______a. The front or belly side of the body

______b. Toward the head end of the body or toward the upper part of the body

______c. Farther away from the head or toward the lower part of the body

______d. The backside of the body

______e. Farther away from a point of reference

______f. Nearer a point of reference, usually the trunk or middle of the body

______g. On the inside of the body

______h. Toward the side of the body or away from midline

______i. On or close to the outside of the body

1. Proximal
2. External or superficial
3. Distal
4. Anterior or ventral
5. Internal or deep
6. Lateral
7. Medial
8. Posterior or dorsal
9. Superior
10. Inferior

6. Match the locating terms on the right with the correct descriptions

______a. Refers to the head or head end

______b. Refers to the tail or tail end

______c. The front or palm of the hand

______d. The sole or bottom of the foot

______e. The side of a curved organ with the larger curve

1. Greater curvature
2. Caudal
3. Plantar
4. Lesser curvature
5. Cephalic or cranial
6. Palmar

7. Match the body positions on the right with the correct descriptions.

______a. Standing or sitting up

______b. Lying down on the back, face up

______c. Lying abdomen down, face down (or to the side)

______d. Lying on the side

1. Prone
2. Lateral
3. Supine or dorsal recumbent
4. Erect

Written Test

8. List the three general regions of the body.

   a. ____

   b. ____

   c. ____

9. Complete the following chart outlining the body cavities and their contents.

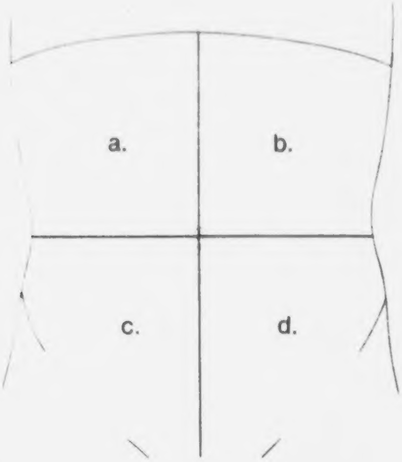
CAVITIES	CONTENTS
a. Dorsal cavity	
(1) ______________	Brain and pituitary gland
(2) Spinal cavity	______________
b. Ventral cavity	
(1) Thoracic cavity	
(a) ______ cavities (2)	Each one contains a lung
(b) Pericardial cavity	______________
(c) Mediastinal space	Thymus gland, trachea, esophagus, bronchi, ends of the 2 vena cavae, beginning of the aorta, heart
(2) Abdominopelvic cavity	
(a) ______ cavity	Within peritoneum Stomach, liver, gallbladder, spleen, pancreas, most of small and large intestine Behind peritoneum Kidney, ureters, adrenal glands
(b) Pelvic cavity	______________, female/male sex organs, part of large intestine: cecum, appendix, rectum

Written Test

10. Identify the quadrants of the abdominopelvic cavity.

a. ______________________ c. ______________________

b. ______________________ d. ______________________



11. Classify organs in the abdominopelvic cavity according to their quadrant locations on the right.

_____a. Gallbladder

_____b. Spleen

_____c. Left kidney

_____d. Cecum

_____e. Lower right ureter

_____f. Right kidney

_____g. Appendix

_____h. Bile ducts

_____i. Most of the liver

_____j. Lower part of left ureter

1. Right upper quadrant
2. Left upper quadrant
3. Right lower quadrant
4. Left lower quadrant

Written Test

12. Identify the nine abdominal regions.

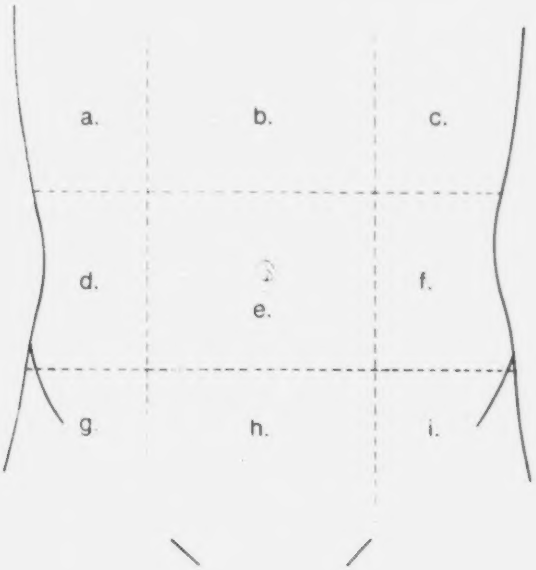
a. ______________________ f. ______________________

b. ______________________ g. ______________________

c. ______________________ h. ______________________

d. ______________________ i. ______________________

e. ______________________



13. Arrange in order the major types of body structures from simplest to most complex by numbering from one to five.

_____a. Organ systems

_____b. Cells

_____c. Organs

_____d. Organism

_____e. Tissues

14. State the single ultimate goal of an organism.

40

____

Written Test

15. List the three basic activities for life of an organism.

a. ______________________________

b. ______________________________

c. ______________________________

16. Complete the following statements concerning the composition of the human body by circling the correct answers.

a. (Liquids, Solids) make up about 40 percent of the total body composition.

b. Fluids are found in (two, three) major compartments of the body.

c. Outside the cells refers to (extracellular, intracellular) fluid.

17. Match the major organ systems of the human body on the right with the correct descriptions.

______a. Covers the body; protects the organisms from injury, disease, and infection; and functions in temperature regulation, excretion of wastes, and the receiving of sensations

______b. Provides the framework for the body and works to protect and support the body

______c. Provides for movement and support

______d. Coordinates body activities by receiving, interpreting, and conducting messages to all other systems of the body

______e. Functions in receiving special sensations such as sight, smell, hearing, and taste

______f. Receives, digests, and absorbs food substances and excretes waste products

1. Nervous system
2. Reproductive system
3. Digestive system
4. Muscular system
5. Integumentary system
6. Urinary system
7. Endocrine system
8. Circulatory system
9. Skeletal system
10. Respiratory system
11. Special sense system

Written Test

______g. Transports materials throughout the body by carrying oxygen and nutrients in the blood to all cells of the body and carrying away the waste products from the cells

______h. Takes in oxygen from the air and gives off carbon dioxide (CO$_2$) that is produced by cell metabolism

______i. Serves in the removal of waste products from the blood excreted in the form of urine

18. Match the major organ systems on the right with their correct organs and structures.

______a. Skin, hair, nails, and glands

______b. Bones, joints, cartilage, and connective tissue

______c. Skeletal, smooth, and cardiac muscles

______d. Brain, spinal cord, and all peripheral nerves

______e. Eye, ear, nose, and taste buds

______f. Mouth, pharynx, esophagus, stomach, small and large intestine, and accessory organs such as gallbladder or pancreas

______g. Heart, blood vessels, blood and lymphatic tissues including the spleen, lymphatic vessels, and lymph

______h. Male/female sex organs and the ducts to the outside

______i. All of the ductless glands such as pituitary, thyroid, and adrenal glands

1. Urinary system
2. Endocrine system
3. Muscular system
4. Reproductive system
5. Nervous system
6. Skeletal system
7. Circulatory system
8. Integumentary system
9. Digestive system
10. Special sense system
11. Respiratory system

***Permission to duplicate this test is granted.**

Organization of the Body
Unit 1

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

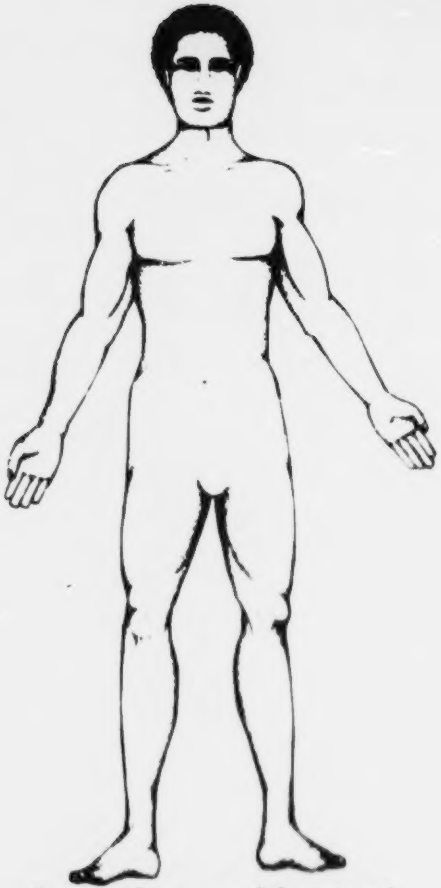
____

Teacher Signature ______________________________ Date __________

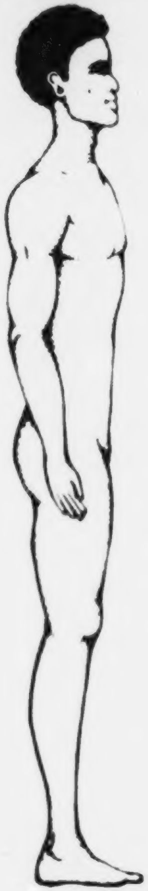
Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.**

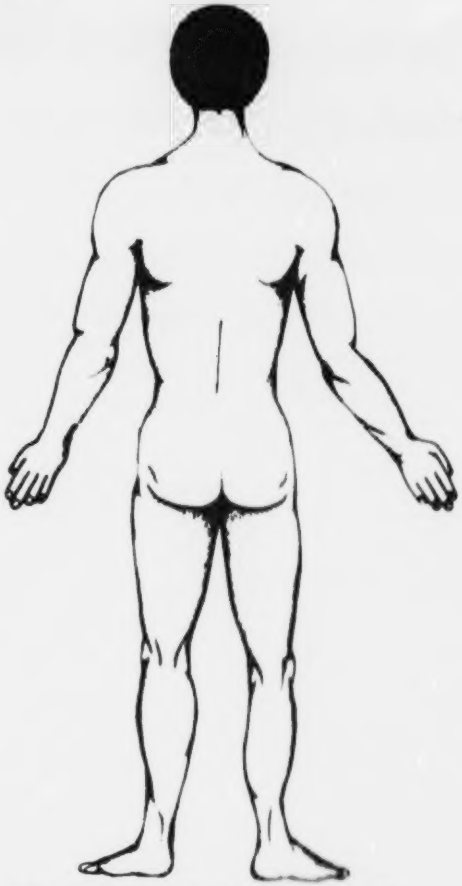
Anatomical Position



Anterior or Ventral View

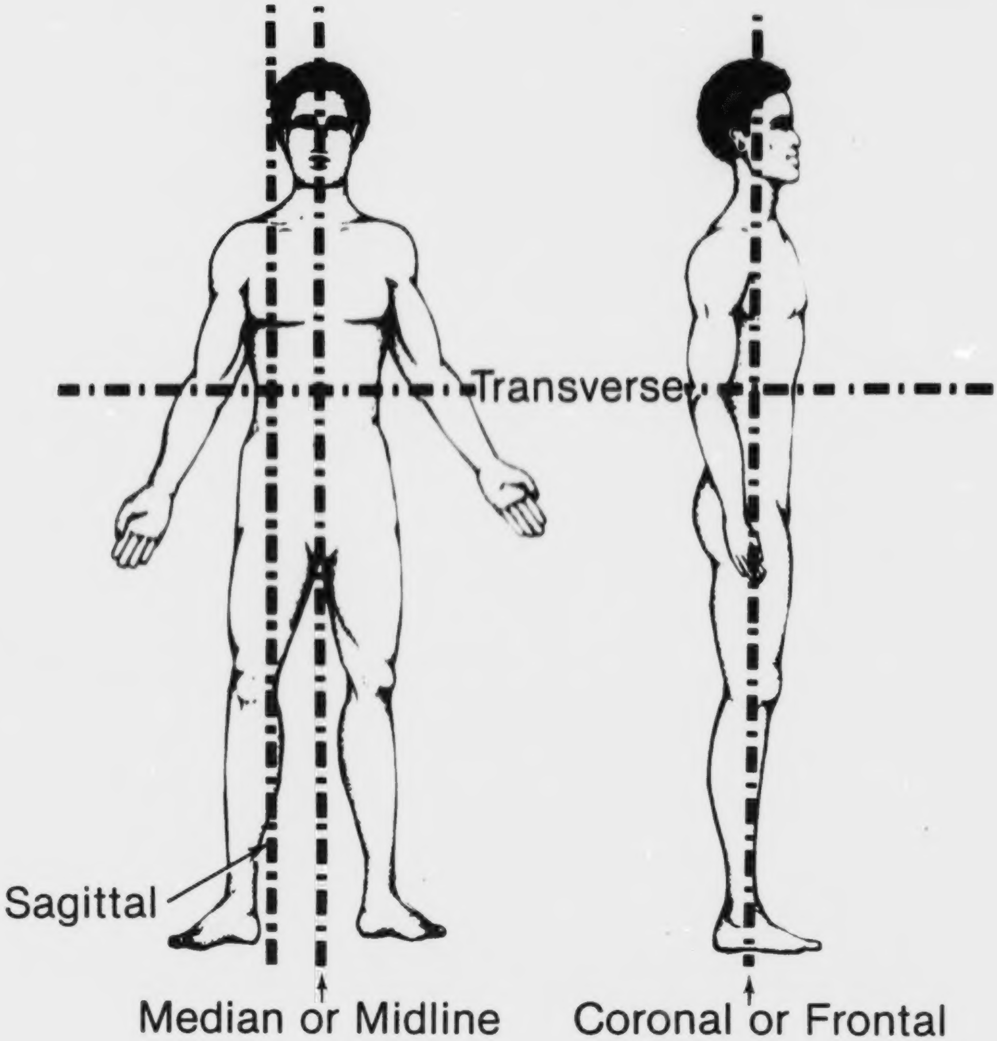


Lateral View

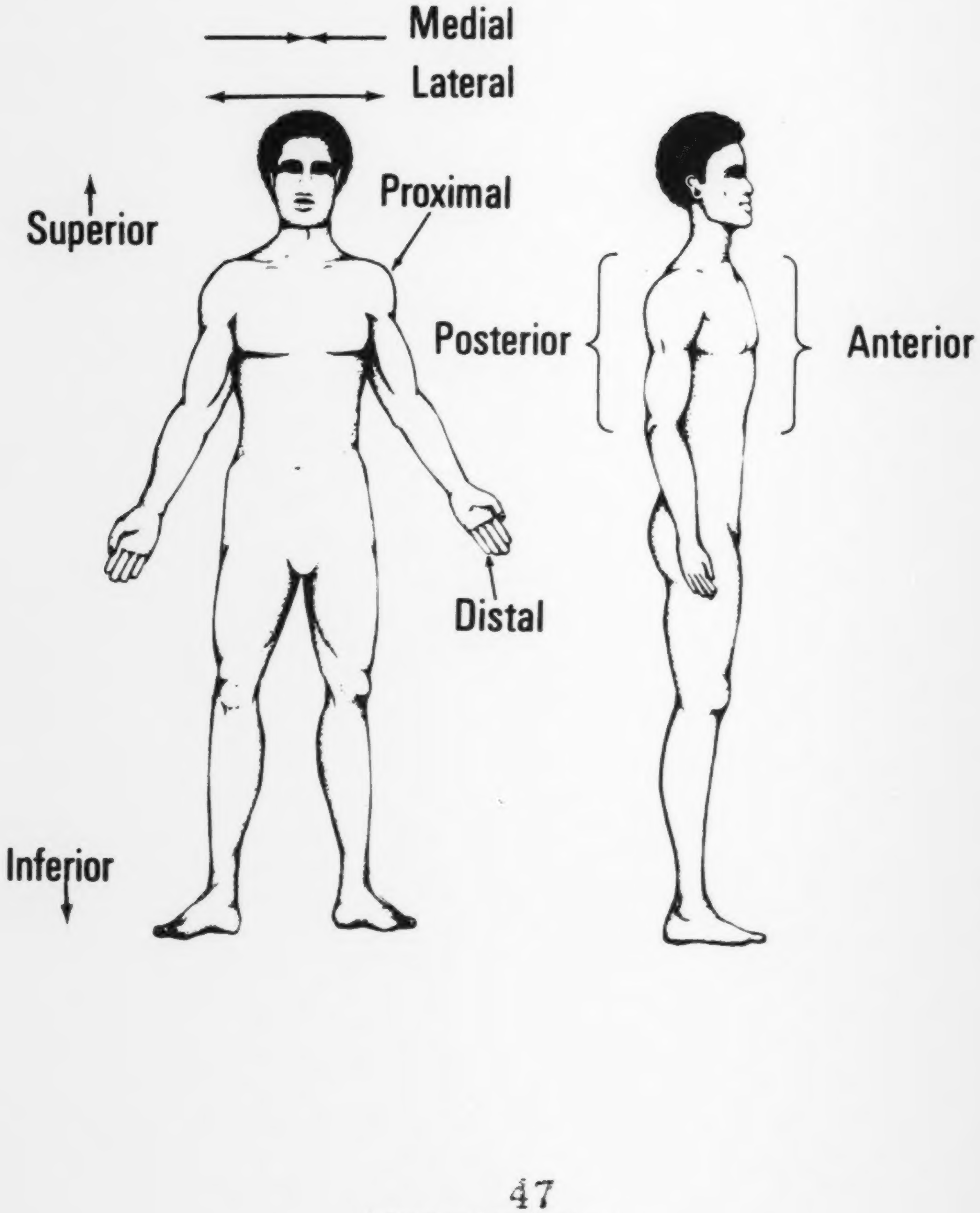


Posterior or Dorsal View

Body Planes

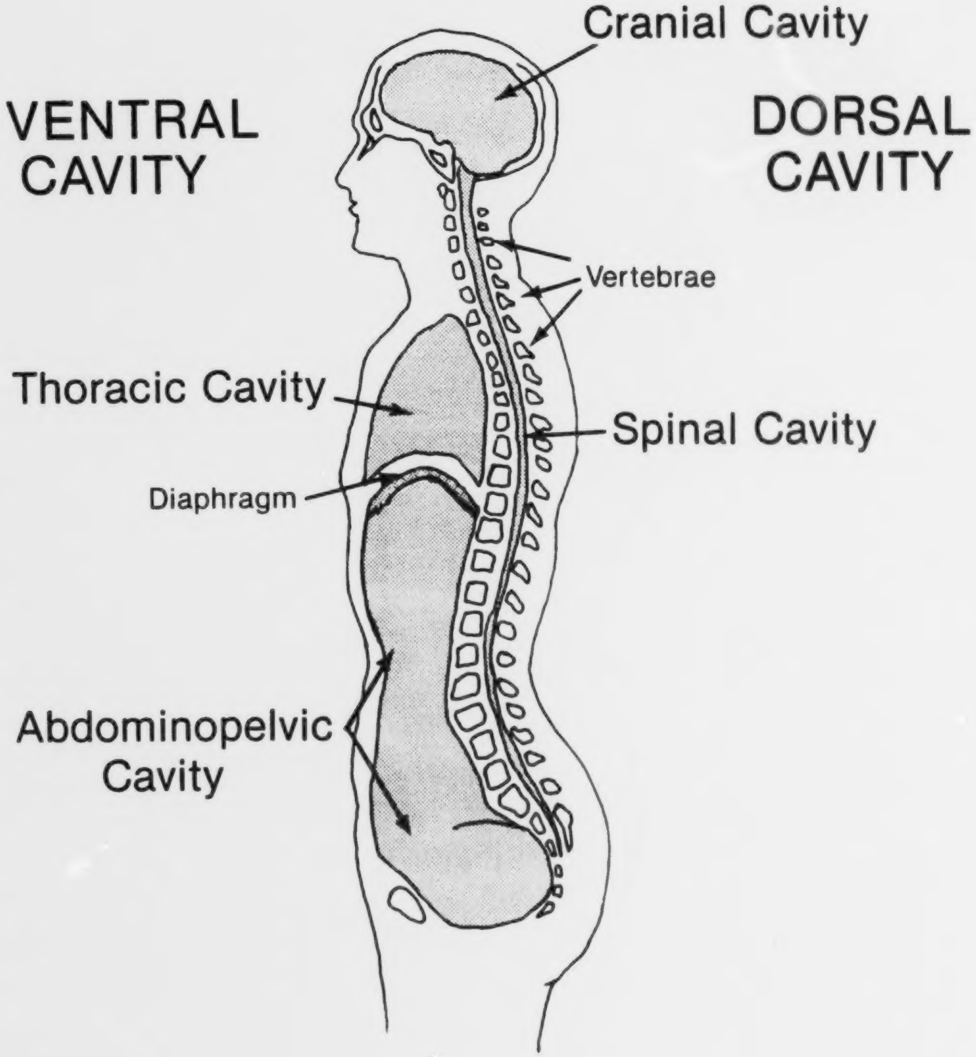

Transverse
Sagittal
Median or Midline
Coronal or Frontal

Directions

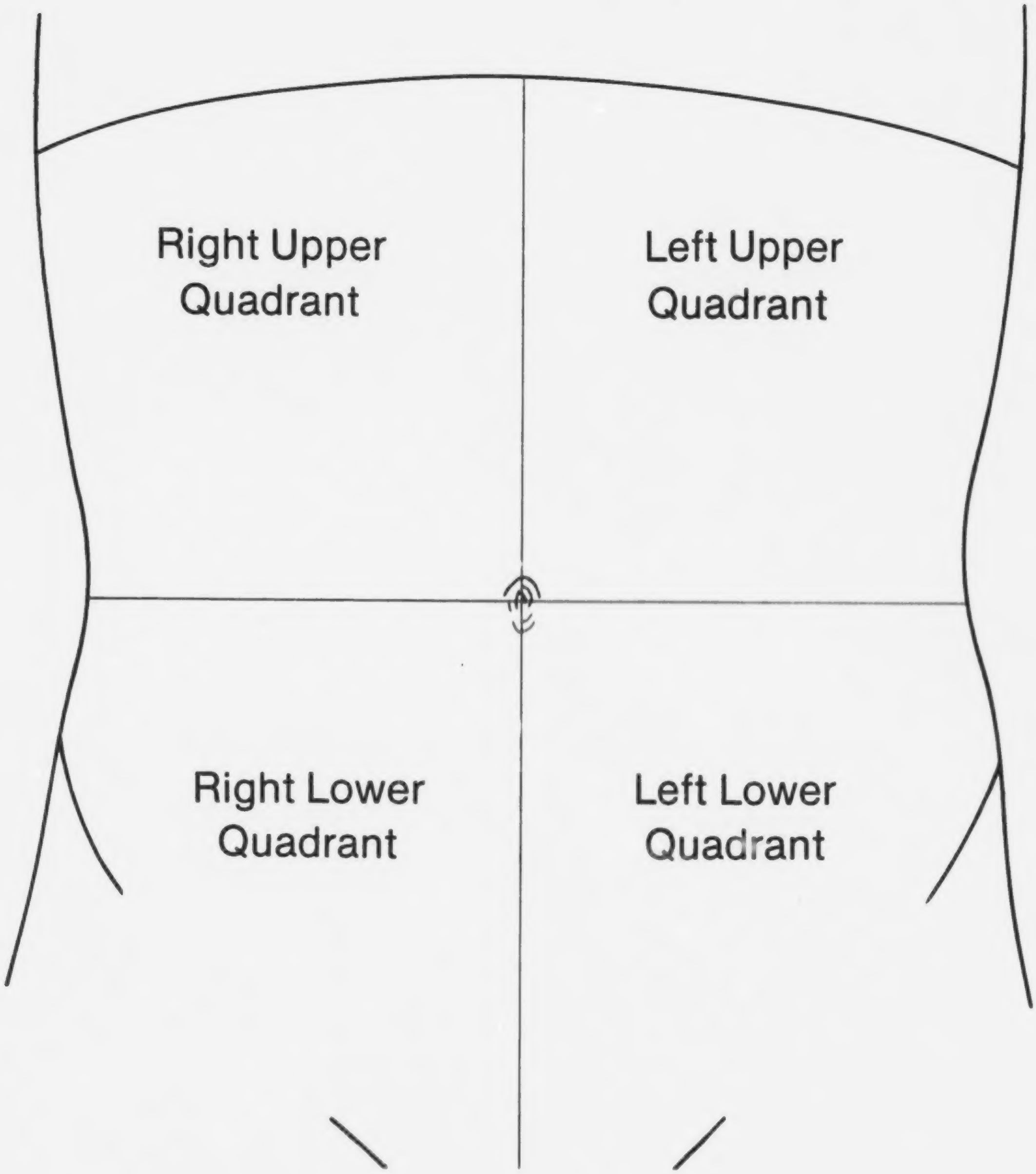

Medial
Lateral
Superior
Proximal
Posterior
Anterior
Distal
Inferior

Body Cavities

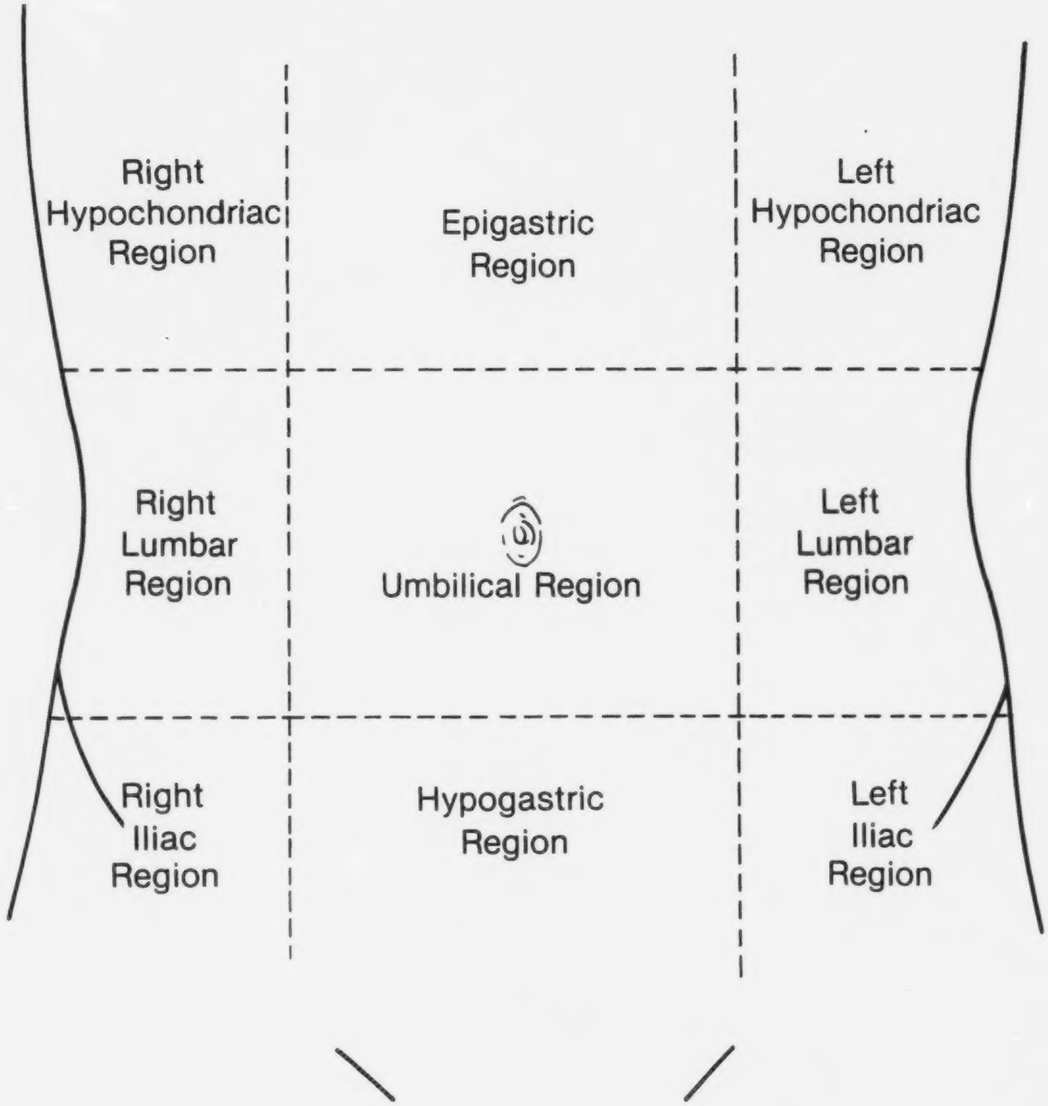
(Side View)


Cranial Cavity
VENTRAL CAVITY
DORSAL CAVITY
Vertebrae
Thoracic Cavity
Spinal Cavity
Diaphragm
Abdominopelvic Cavity

Quadrants of the Abdominopelvic Cavity


Right Upper Quadrant
Left Upper Quadrant
Right Lower Quadrant
Left Lower Quadrant

Regions of the Abdomen


Right Hypochondriac Region
Epigastric Region
Left Hypochondriac Region
Right Lumbar Region
Umbilical Region
Left Lumbar Region
Right Iliac Region
Hypogastric Region
Left Iliac Region

Organization of the Body
Unit 1

Information Sheet

1. **Terms and definitions**

   a. **Bisymmetry** — A pattern of animal symmetry in which similar parts are arranged on opposite sides of a median axis so that one and only one plane can divide the individual into essentially identical halves

   b. **Body planes** — Imaginary lines or cuts separating the body into specific areas

   c. **Cavity** — A hollowed out space

   d. **Cell** — The simplest form of living matter that is capable of maintaining life and reproducing itself

   e. **Organ** — Several types of tissues arranged in an organized manner to perform a particular function

   f. **Organism** — Group of organ systems which make up an integrated whole person or animal

   g. **Organ system** — Group of varying numbers and types of organs arranged together to perform complex functions of the body

   h. **Quadrant** — Any of the four quarters into which something is divided by two real or imaginary lines that intersect each other at right (90°) angles

   i. **Recumbent** — Lying down

   j. **Tissue** — Group of similar cells arranged with intercellular substance between them specialized to perform a particular function

2. **Definitions of anatomy and physiology**

   Note: The study of the human body is covered by these two separate, but interrelated, sciences.

   a. **Anatomy** — Scientific study of the structure of an organism which describes the size, shape, construction, and relative positions of the organs in the body

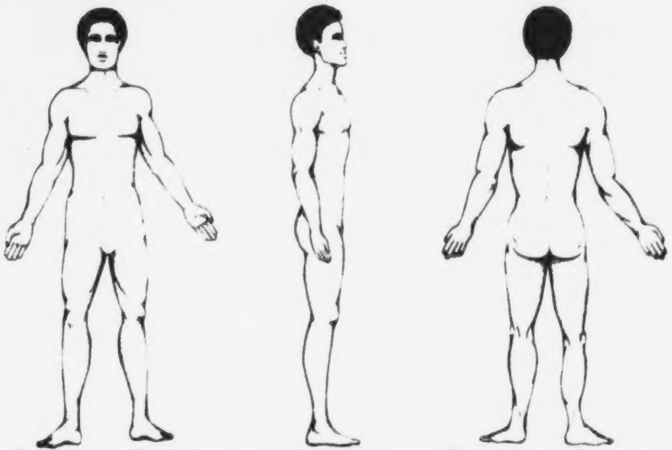
   b. **Physiology** — Scientific study of the functions of an organism which describes how the organs work independently and in relation to the whole organism

Information Sheet

3. **Anatomical position** — The body standing erect, with arms at the side and the palms facing forward (Figure 1)

   Note: All terms used in describing the body presuppose a set position of the body. If a person were standing on his/her head, the terms "above" and "below" would mean something entirely different than if he/she were standing upright.

   Figure 1—Anatomical Position



Anterior or Ventral View

Lateral View

Posterior or Dorsal View

4. **Body planes** (Figure 2)

   a. **Median or midline plane** — A lengthwise plane through the midline running front to back dividing the body into equal right and left halves

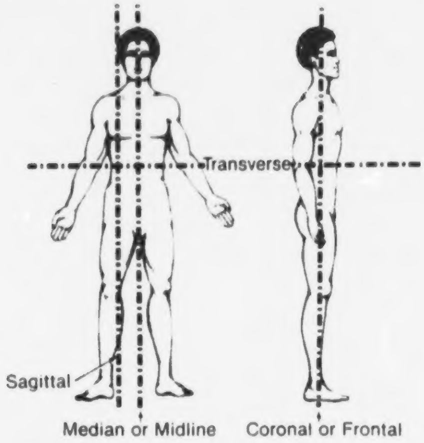
   b. **Sagittal plane** — A lengthwise plane parallel to the midline running front to back dividing the body or any part of it into unequal right and left sides or parts

   c. **Coronal or frontal plane** — A lengthwise plane running side-to-side dividing the body into front and back parts

   d. **Transverse or horizontal plane** — A crosswise plane dividing the body into upper and lower parts

Information Sheet

Figure 2—Body Planes



5. **Directional terms** (Figure 3)

Note: Directional terms make it possible to say that something is above, below, to the left or right of, behind or in front of, and nearer or farther from something else.

a. **Superior** — Toward the head end of the body or toward the upper part of the body

Example: The heart is *superior* to the stomach.

b. **Inferior** — Farther away from the head or toward the lower part of the body

Example: The stomach is *inferior* to the heart.

c. **Anterior or ventral** — The front or belly side of the body

Example: The toes are *anterior* or *ventral.*

d. **Posterior or dorsal** — The backside of the body

Example: The heels are *posterior* or *dorsal.*

e. **Proximal** — Nearer a point of reference, usually the trunk or middle of the body

Example: The shoulder is *proximal* to the elbow.

f. **Distal** — Farther away from a point of reference

Example: The elbow is *distal* to the shoulder.

g. **Medial** — Closer to the midline of the body

Example: The little finger is *medial* when the body is in its anatomical position.

Information Sheet

h. **Lateral** — Toward the side of the body or away from midline

Example: The thumb is *lateral* when the body is in its anatomical position.

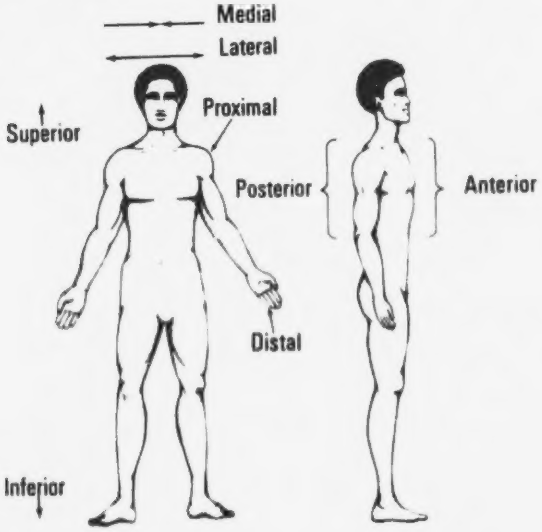
i. **Internal or deep** — On the inside of the body

Example: The liver is *internal.*

j. **External or superficial** — On or close to the outside of the body

Example: The outer ear is *external.*

Figure 3—Directions



6. **Locating terms**

a. **Cephalic or cranial** — Refers to the head or head end

Example: When a baby is born head first, it is known as a *cephalic presentation.*

b. **Caudal** — Refers to the tail or tail end

Example: A *caudal* anesthesia is given near the tail end of the spinal canal.

c. **Palmar** — The front or palm of the hand

Example: A *palmar* wart is on the palm of the hand.

Information Sheet

d. **Plantar** — The sole or bottom of the foot

Example: A *plantar's* wart is on the bottom of the foot.

e. **Greater curvature** — The side of a curved organ with the larger curve

f. **Lesser curvature** — The side of a curved organ with the smaller curve

7. **Body positions**

a. **Erect** — Standing or sitting up

b. **Supine or dorsal recumbent** — Lying down on the back, face up

Note: This is used to perform surgery on the anterior surface of the body such as abdominal, pelvic, or facial surgery.

c. **Prone** — Lying abdomen down, face down (or to the side)

Note: This is used to perform surgery on the posterior surface of the body such as the back, the rectal area, or the posterior legs.

d. **Lateral** — Lying on the side

Note: This is used to perform surgery on the upper chest, kidney, and upper ureter.

8. **General regions of the body**

a. **Head**

Note: This region includes the cranium and the face.

b. **Trunk (Torso)**

Note: This region includes the neck, back, thorax, abdomen, pelvis, and perineum.

c. **Limbs (Extremities)**

Note: This region includes the upper and lower limbs.

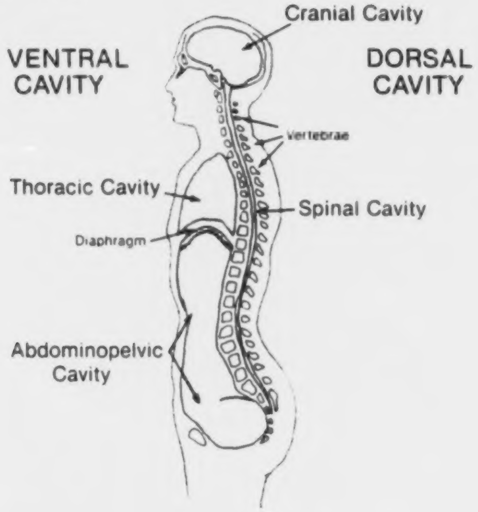
Information Sheet

9. Body cavities and their contents (Figure 4)

CAVITIES	CONTENTS
A. **Dorsal cavity**	
(1) **Cranial cavity**	Brain and pituitary gland
(2) **Spinal cavity**	Spinal cord
B. **Ventral cavity**	
(1) **Thoracic cavity** (chest-above the diaphragm)	
(a) Pleural cavities (2)	Each one contains a lung
(b) Pericardial cavity	Heart
(c) Mediastinal space	Thymus gland, trachea, esophagus, bronchi, ends of the 2 vena cavae, beginning of the aorta, heart
(2) **Abdominopelvic cavity** (below the diaphragm)	
(a) Abdominal cavity (upper)	Within peritoneum — Stomach, liver, gallbladder, spleen, pancreas, most of small and large intestine Behind (retro) peritoneum — Kidney, ureters, adrenal glands
(b) Pelvic cavity (lower) Note: This roughly begins on a line along the level of the iliac crests.	Urinary bladder, female/male sex organs, part of large intestine: cecum, appendix, rectum

Information Sheet

Figure 4—Body Cavities


Cranial Cavity
VENTRAL CAVITY
DORSAL CAVITY
Vertebrae
Thoracic Cavity
Spinal Cavity
Diaphragm
Abdominopelvic Cavity

10. **Quadrants of the abdominopelvic cavity** (Figure 5)

Note: Remember when you are looking at a drawing or picture of the body or when looking at a person facing you, the right side is *their* right side or *your* left side.

a. Right upper quadrant — RUQ

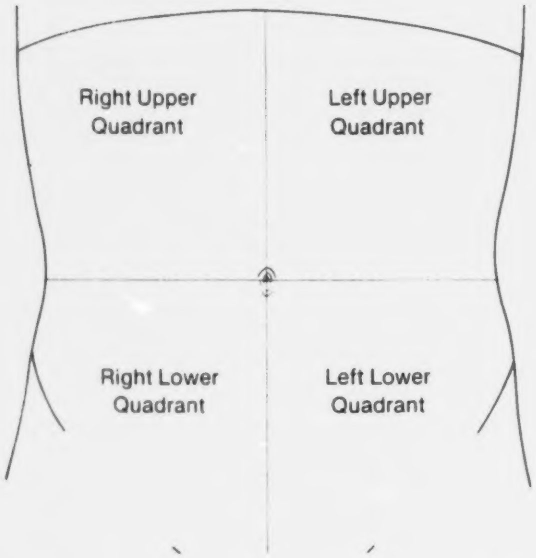
b. Left upper quadrant — LUQ

c. Right lower quadrant — RLQ

d. Left lower quadrant — LLQ

Information Sheet

Figure 5—Quadrants of the Abdominopelvic Cavity


Right Upper Quadrant
Left Upper Quadrant
Right Lower Quadrant
Left Lower Quadrant

11. Organs located within the quadrants

a. Right upper quadrant (RUQ)

(1) Part of the small intestine including the descending duodenum

(2) Upper ascending colon

(3) Most of the liver

(4) Gallbladder

(5) Bile ducts

(6) Head of the pancreas

(7) Right adrenal gland

(8) Right kidney

(9) Upper part of right ureter

Information Sheet

b. **Left upper quadrant (LUQ)**

  (1) Ascending part of duodenum

  (2) Upper descending colon

  (3) Left half of transverse colon

  (4) Spleen

  (5) Small part of liver

  (6) Left adrenal gland

  (7) Left kidney

  (8) Upper part of left ureter

  (9) Stomach

c. **Right lower quadrant (RLQ)**

  (1) Lower ascending colon

  (2) Cecum

  (3) Appendix

  (4) Lower right ureter

  (5) Terminal ileum

  (6) Part of urinary bladder

  (7) Sex organs

d. **Left lower quadrant (LLQ)**

  (1) Lower descending colon

  (2) Small intestine (part of ileum)

  (3) Lower part of left ureter

  (4) Part of urinary bladder

  (5) Sex organs

Information Sheet

12. **Nine abdominal regions** (Figure 6)

   a. Right hypochondriac region

   b. Epigastric region

   c. Left hypochondriac region

   d. Right lumbar region

   e. Umbilical region

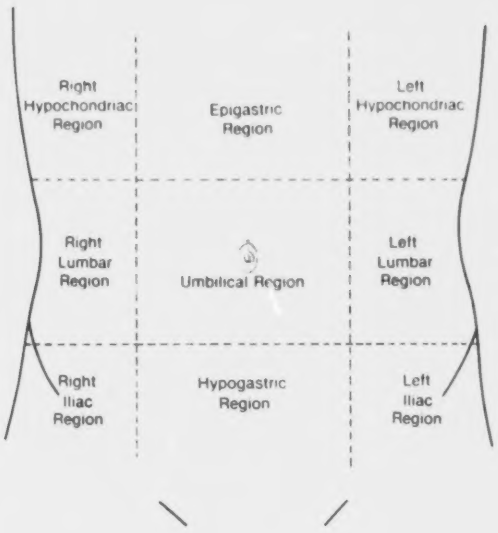
   f. Left lumbar region

   g. Right iliac region

   h. Hypogastric region

   i. Left iliac region

Figure 6—Regions of the Abdomen


Right Hypochondriac Region
Epigastric Region
Left Hypochondriac Region
Right Lumbar Region
Umbilical Region
Left Lumbar Region
Right Iliac Region
Hypogastric Region
Left Iliac Region

BEST COPY AVAILABLE

Information Sheet

13. **Major types of body structures ranging from simplest to most complex**

    a. Cells

    Note: It has been estimated that there are approximately 100 trillion cells in the human body.

    Example: Nerve cell

    b. Tissues

    Example: Nerve tissue

    c. Organs

    Examples: Heart, stomach

    d. Organ systems

    Examples: Digestive, respiratory

    e. Organism

    Examples: Human being

14. **Single ultimate goal of an organism** — Survival

15. **Basic activities for life of an organism**

    a. Movement

    b. Metabolism

    c. Reproduction

    Note: The activities of the organism are directly related to the activities of the smallest structures, the cells.

16. **Composition of the human body**

    a. The human body is composed of solids and liquids (water).

    b. Solids make up about 40 percent of the total body composition.

    c. Liquids make up about 60 percent of the total body composition.

    d. Fluids are found in two major compartments of the body.

    (1) Within the cells — Intracellular fluid

    (2) Outside the cells — Extracellular fluid

Information Sheet

17. Major organ systems of the human body and their descriptions

Note: These organ systems help maintain homeostasis as well as integrate, protect, support, and control the many cells of the human organism.

a. **Integumentary (skin) system** — Covers the body; protects the organism from injury, disease, and infection; and functions in temperature regulation, excretion of wastes, and the receiving of sensations

b. **Skeletal system** — Provides the framework for the body and works to protect and support the body

Note: Muscles attach to the bones to provide for movement and support

c. **Muscular system** — Provides for movement and support

d. **Nervous system** — Coordinates body activities by receiving, interpreting, and conducting messages to all other systems of the body

e. **Special sense system** — Functions in receiving special sensations such as sight, smell, hearing, and taste

f. **Digestive system** — Receives, digests, and absorbs food substances and excretes waste products

g. **Circulatory system** — Transports materials throughout the body by carrying oxygen and nutrients in the blood to all cells of the body and carrying away the waste products from the cells

h. **Respiratory system** — Takes in oxygen from the air and gives off carbon dioxide (CO_2) that is produced by cell metabolism

i. **Urinary system** — Serves in the removal of waste products from the blood excreted in the form of urine

j. **Reproductive system** — Involved with reproduction and childbirth

k. **Endocrine system** — Serves to regulate various body functions through glands which secrete hormones directly into the blood that slow down or increase the activity of the cells

Information Sheet

18. **Major organ systems and their organs and structures**

    a. **Integumentary system** — Skin, hair, nails, and glands

    b. **Skeletal system** — Bones, joints, cartilage, and connective tissue

    c. **Muscular system** — Skeletal, smooth, and cardiac muscles

    d. **Nervous system** — Brain, spinal cord, and all peripheral nerves

    e. **Special sense system** — Eye, ear, nose, and taste buds

    f. **Digestive system** — Mouth, pharynx, esophagus, stomach, small and large intestine, and accessory organs such as gallbladder or pancreas

    g. **Circulatory system** — Heart, blood vessels, blood and lymphatic tissues including the spleen, lymphatic vessels, and lymph

    h. **Respiratory system** — Lungs and upper respiratory tract (nose, pharynx, larynx, trachea, and bronchi)

    i. **Urinary system** — Kidneys, ureters, bladder, and urethra

    j. **Reproductive system** — Male/female sex organs and the ducts to the outside

    k. **Endocrine system** — All of the ductless glands such as pituitary, thyroid, and adrenal glands

Cells, Tissues, and Membranes
Unit 2

Objective Sheet

Unit Objective

After completing this unit, the student should be able to identify the major parts of a cell and complete statements concerning cells, tissues, and membranes. The student should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to cells, tissues, and membranes with their correct definitions.
2. Match compounds in protoplasm with the correct descriptions.
3. Distinguish between the principal types of protoplasm.
4. Identify the major parts of a cell.
5. Select true statements concerning characteristics of the parts of a cell.
6. Select functions of a cell.
7. Distinguish between active and passive transport of material through a cell membrane.
8. Match types of active transport with the correct descriptions.
9. Match types of passive transport with the correct descriptions.
10. Match types of solutions with the correct descriptions.
11. Distinguish between types of cellular reproduction.
12. Match basic types of tissues with the correct functions.
13. Select true statements concerning the characteristics of epithelium.
14. Classify epithelium when given the shape and layer arrangement.

Objective Sheet

15. Match types of connective tissue with the correct locations and functions.
16. Complete statements concerning types of muscle tissue.
17. List two types of nerve tissue.
18. Complete statements concerning the main types of membranes.
19. Demonstrate the transport movement of materials. (Assignment Sheet 1)

Cells, Tissues, and Membranes
Unit 2

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Parts of a Cell (Objectives 4 and 5)
   TM 2—Passive Transport (Objective 9)
   TM 3—Solutions (Objective 10)
   TM 4—Mitotic and Miotic Cell Division (Objective 11)
   TM 5—Epithelial Tissues (Objective 14)
   TM 6—Connective Tissues (Objective 15)
   TM 7—Muscle Tissues (Objective 16)
   TM 8—Nerve Tissues (Objective 17)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the assignment sheet. Review criteria for evaluation of these activities.

12. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

13. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.
14. Make copies of the written test. Add or modify test items as needed.
15. Give written test.
16. Record assignment sheet ratings and written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.
17. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Have students examine slides of cells, tissues, and membranes using a microscope.
2. Show available films explaining the parts of the cell and the types of tissues and membranes.
3. Discuss the difference between normal and abnormal (cancerous) cells.
4. Discuss the reproduction of normal and abnormal cells.
5. Provide the materials necessary for Assignment Sheet 1.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*. 12th ed. St. Louis, MO: C. V. Mosby Company, 1987.
2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.
3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.
4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Brochures and other supplementary information are available from the following organizations:

    a. American Cancer Society
    1599 Clifton Road NE
    Atlanta, GA 30329
    404-320-3333

    b. National Cancer Care Foundation
    1180 Avenue of the Americas
    New York, NY 10036
    212-221-3300

2. Videotape—*Growth and Change*, part of *The Living Body* Series available from:

    Films for the Humanities and Sciences
    P.O. Box 2053
    Princeton, NJ 08543-2053
    800-257-5126 or 609-452-1128

3. Software—*Cell Structure and Function* (Module 1), part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

    Health Sciences Consortium
    201 Silver Cedar Court
    Chapel Hill, NC 27514-1517
    919-942-8731

4. Microscope slides of cells and tissues are available from many health and science education companies. Two of these companies are as follows:

    a. Health Edco
    P.O. Box 21207
    Waco, TX 76702-1207
    800-299-3366, x295 or 817-776-6461, x295

    b. Nebraska Scientific
    3823 Leavenworth Street
    Omaha, NB 68105
    800-228-7117

Cells, Tissues, and Membranes
Unit 2

Answers to Student Supplements and Assignment Sheet

Student Supplement 1

a. Cell nucleus
b. Cell membrane
c. Organelles
d. Specialized structure (microvilli)
e. Cytoplasm

Student Supplement 2

1. d
2. a
3. a
4. c
5. b
6. a
7. c
8. d
9. b
10. d

Student Supplement 3

1. c
2. d
3. a
4. c
5. c
6. b
7. d
8. b
9. a
10. a

Assignment Sheet 1

1. Water will pass through the tubing or membrane into the funnel to equalize the concentration on each side. This is **osmosis**.

2. The food coloring (liquid) will move throughout the water more quickly than the solid tablet will dissolve because the liquid is in a solvent state. This is **diffusion**.

3. The water will run through the tissue, leaving the dirt in the tissue. If the water is cloudy, it indicates either that some particles of dirt dissolved and were able to pass through the tissue or the spaces in the tissue were too large and the smaller particles were able to pass through. This is **filtration**.

Cells, Tissues, and Membranes
Unit 2

Answers to Written Test

1. a. 4
   b. 14
   c. 5
   d. 6
   e. 11
   f. 12
   g. 13
   h. 15
   i. 8
   j. 9
   k. 10
   l. 3

2. a. 2
   b. 5
   c. 4
   d. 1

3. a

4. a. Cell nucleus
   b. Cell membrane
   c. Cytoplasm
   d. Organelles
   e. Specialized structures

5. a, d, e

6. b, c, e, f, g

7. b

8. a. 3
   b. 1
   c. 2

9. a. 2
   b. 3
   c. 1

10. a. 1
    b. 3
    c. 2

11. a

12. a. 3
    b. 4
    c. 1
    d. 2

Answers to Written Test

13. a, b, d, f

14. a. Simple squamous
    b. Stratified cuboidal
    c. Simple cuboidal
    d. Simple columnar

15. a. 6
    b. 3
    c. 8
    d. 1
    e. 7
    f. 5
    g. 4
    h. 2

16. a. Skeletal
    b. Visceral
    c. Heart
    d. Cardiac
    e. Bones

17. a. Neuron
    b. Neuroglia

18. a. Serous
    b. Cutaneous
    c. Mucous
    d. Synovial
    e. Absorption
    f. Body

Cells, Tissues, and Membranes
Unit 2

Written Test

Name ________________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______a. The smallest structural unit of living matter capable of functioning independently

______b. Group of similar cells arranged with intercellular substance between them specialized to perform a particular function

______c. Surface layer of the cytoplasm of a cell

______d. The study of the structure, function, multiplication, and pathology of cells

______e. The central structure of a cell enclosed in a membrane which is essential to cellular functions such as reproduction and protein synthesis

______f. The living matter in all cells which is an organized complex of organic and inorganic substances which are too small for resolution with an ordinary light microscope

______g. A membrane which allows some molecules to pass through but not others

______h. A small cavity or space in cell protoplasm containing air or fluid

______i. Substances such as acids, bases, and salts which, in solution, conduct an electric current

______j. A relatively stable state of equilibrium

1. Anabolism
2. Body membrane
3. Catabolism
4. Cell
5. Cell membrane
6. Cytology
7. Electrolyte balance
8. Electrolytes
9. Homeostasis
10. Metabolism
11. Nucleus
12. Protoplasm
13. Semipermeable membrane
14. Tissue
15. Vacuole

Written Test

______k. The process of continually building up and using protoplasm to carry on vital processes and activities

______l. The destructive part of metabolism involving the release of energy and resulting in the breakdown of complex materials within the organism

2. Match compounds in protoplasm on the right with the correct descriptions.

______a. Most abundant compound in protoplasm that serves as the solvent in all cell chemistry

______b. Second most abundant compound in animal protoplasm that forms the structural framework of protoplasm

______c. Serve as energy sources

______d. Control the growth and reproduction of the cells

1. Nucleic acids
2. Water
3. Mineral salts
4. Carbohydrates and fats
5. Protein

3. Distinguish between the principal types of protoplasm by placing an "X" next to the definition of nucleoplasm.

______a. The protoplasm making up the cell's nucleus

______b. All the protoplasm not contained in the nucleus

Written Test

4. Identify the major parts of a cell.

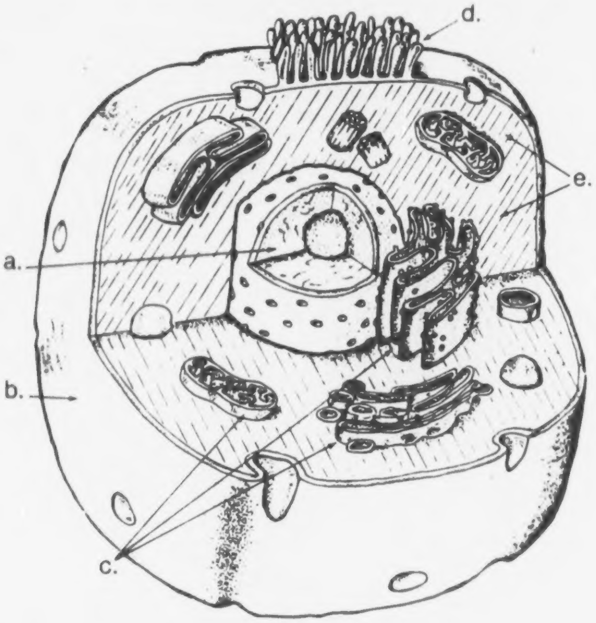
a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________



5. Select true statements concerning characteristics of the parts of a cell by placing an "X" next to the true statements.

______a. Cell nucleus regulates cellular structure and activities, including reproduction of the cell.

______b. The nucleolus consists of strands of DNA bearing the genes which carry the hereditary characteristics.

______c. Cell membrane is the permeable outer wall of the cell which allows all molecules to pass through.

Written Test

______d. Cytoplasm performs activities such as secretion and absorption.

______e. Types of organelles include endoplasmic reticula, golgi apparatus, mitochondria, lysosomes, ribosomes, and centrosomes.

______f. Flagellum are tiny, hairline projections which are found on the epithelial cells forming the surface of the mucous membrane lining parts of the respiratory tract.

6. Select functions of a cell by placing an "X" next to the correct functions.

______a. Retain energy

______b. Consume oxygen

______c. Move substances into and out of the cell

______d. Produce carbohydrates

______e. Reproduce itself

______f. Synthesize proteins

______g. Metabolize nutrients

7. Distinguish between active and passive transport of material through a cell membrane by placing an "X" next to the description of passive transport.

______a. Requires energy from the cell or wraps itself around a foreign particle

______b. Requires no energy from the cell; moves through solution methods of movement

Written Test

8. Match the types of active transport on the right with the correct descriptions.

_______a. An active transport mechanism that moves molecules or ions through cell membranes in an uphill direction, making their concentration gradients go up, against their natural tendency

_______b. The process of engulfing a *solid* particle by forming a pocket with the cell membrane, pinching off from the rest of the membrane, and migrating into the cell as a closed vacuole

_______c. The process of engulfing a *liquid* particle by forming a pocket with the cell membrane, pinching off from the rest of the membrane, and migrating into the cell as a closed vacuole

1. Phagocytosis
2. Pinocytosis
3. Physiological pump

9. Match the types of passive transport on the right with the correct descriptions.

_______a. Particles move to equalize concentration throughout

_______b. Particles move through a filter or membrane that prevents passage of certain molecules

_______c. Solvent molecules pass through a semi-permeable membrane to equalize concentration on each side

1. Osmosis
2. Diffusion
3. Filtration

10. Match types of solutions on the right with the correct descriptions.

_______a. Has the same concentration of dissolved particles as the solution with which it is compared

_______b. Condition in which a solution contains a lesser concentration of dissolved particles than the solution with which it is compared

_______c. Condition in which a solution contains a greater concentration of dissolved particles than the solution with which it is compared

1. Isotonic solution
2. Hypertonic solution
3. Hypotonic solution

Written Test

11. Distinguish between types of cellular reproduction by placing an "X" next to the description of mitosis.

_______a. Occurs in all human cells except reproductive cells and nerve tissue cells; gives rise to two daughter cells which are identical to parent cell; takes place in four stages: prophase, metaphase, anaphase, and telophase

_______b. Occurs in reproductive (sex) cells; gives rise to four daughter cells which contain only half the number of chromosomes found in parent cell

12. Match the basic types of tissues on the right with the correct functions.

_______a. Acts as a protective barrier from heat, cold, water loss, and bacterial invasion; aids in secretion and excretion

_______b. Protects, supports, transports, and binds the body together

_______c. Moves body by contraction/relaxation of pairs

_______d. Conducts impulses throughout the body

1. Muscle
2. Nerve
3. Epithelial
4. Connective

13. Select true statements concerning characteristics of epithelium by placing an "X" next to the true statements.

_______a. Covers the body and many of its parts

_______b. Lines the body's serous cavities, blood and lymph vessels, and the respiratory, digestive, and urinary tracts

_______c. Forms the body's connective tissues

_______d. Has close cellular arrangement with very little intercellular substance

_______e. Contains blood vessels; receives oxygen and nutrients by diffusing upward from blood vessels of the connective tissue which always lies underneath the epithelium

_______f. Has a basement membrane which lies between the epithelial and connective tissue

_______g. Undergoes mitosis occasionally to replace the upper layer of cells which are lost to normal wear and tear

Written Test

14. Classify the following epithelium when given the shape and layer arrangement.

    a. Flat, single layer — ____________________

    b. Multiple layer, cubelike — ____________________

    c. Cubelike, single layer — ____________________

    d. Single layer, taller than wide — ____________________

15. Match the types of connective tissue on the right with the correct locations and functions.

    _____a. (1) Location — Spleen, lymph nodes, and bone marrow
    (2) Function — Filters injurious substances from blood and lymph by the reticular network; phagocytosis

    _____b. (1) Location — Between other tissues, organs, and superficial tissues
    (2) Function — Connects tissues

    _____c. (1) Location — Under skin as padding
    (2) Function — Protects, insulates, supports, and acts as reservoir for food

    _____d. (1) Location — Tendons, ligaments, deep fascia, dermis, scars, capsule of kidney
    (2) Function — Flexible, but strong connecting tissue

    _____e. (1) Location — Skeleton
    (2) Function — Protects, supports

    _____f. (1) Location — Nasal septum, covering surfaces of bones, larynx rings in trachea, and bronchi vertebral discs, external ear, eustachian tube
    (2) Function — Firm, but flexible support

    1. Fibrous
    2. Blood
    3. Areolar
    4. Hemopoietic
    5. Cartilage
    6. Reticular
    7. Bone
    8. Adipose

Written Test

_____g. (1) Location
  (a) Myeloid — Bone marrow
  (b) Lymphatic — Lymph nodes, spleen, tonsils, and thymus
 (2) Function
  (a) Myeloid — Formation of red and white blood cells and platelets
  (b) Lymphatic — Formation of lymphocytes and monocytes

_____h. (1) Location — Blood vessels
 (2) Function — Transportation, protection

16. Complete the following statements concerning types of muscle tissue by circling the correct answers.

    a. (Skeletal, Visceral) muscle tissue is striated, voluntary.

    b. (Skeletal, Visceral) muscle tissue is found in walls of hollow organs such as blood vessels, intestines, and uterus.

    c. Cardiac muscle tissue composes the walls of the (heart, blood vessels).

    d. (Cardiac, Skeletal) muscle tissue is striated, involuntary.

    e. Skeletal muscle tissue is attached to (organs, bones).

17. List two types of nerve tissue.

    a. ______________________________

    b. ______________________________

18. Complete the following statements concerning the main types of membranes by circling the correct answers.

    a. (Serous, Mucous) membranes line closed cavities of the body such as thoracic cavity, abdominal cavity, and sac in which heart lies.

    b. (Serous, Cutaneous) membranes have essentially two layers, the epidermis and dermis.

    c. Cutaneous membranes are continuous with (serous, mucous) membranes.

Written Test

d. (Synovial, Serous) membranes line joint, tendons, and bursae.

e. Mucous membranes function in protection, secretion of mucus, and (excretion, absorption).

f. Cutaneous membranes cover the (organs, body).

***Permission to duplicate this test is granted.**

Cells, Tissues, and Membranes
Unit 2

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Assignment Sheet 1—Demonstrate the Transport Movement of Materials Rating _____

Comments: ____

____

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

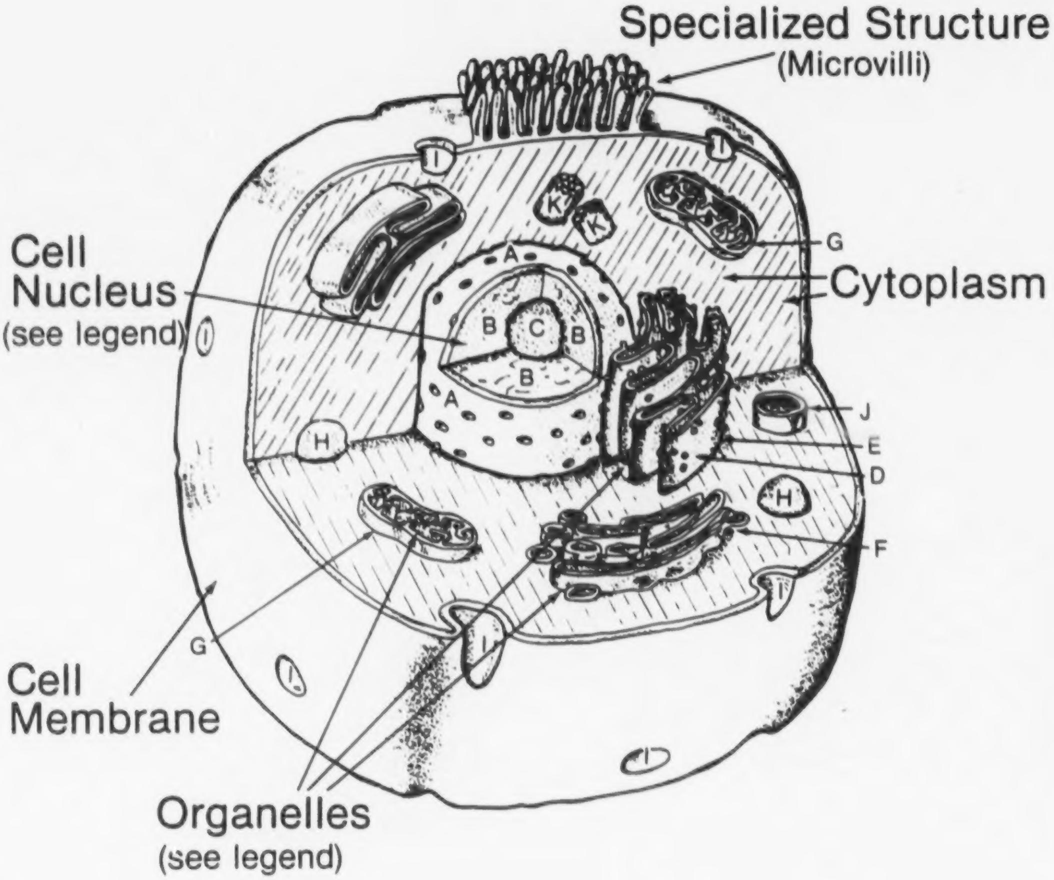
____

Teacher Signature ______________________________ Date __________

Student Signature ______________________________ Date __________

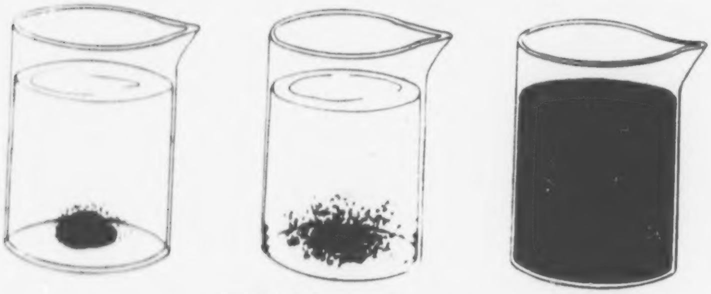
***Permission to duplicate this form is granted.**

Parts of a Cell

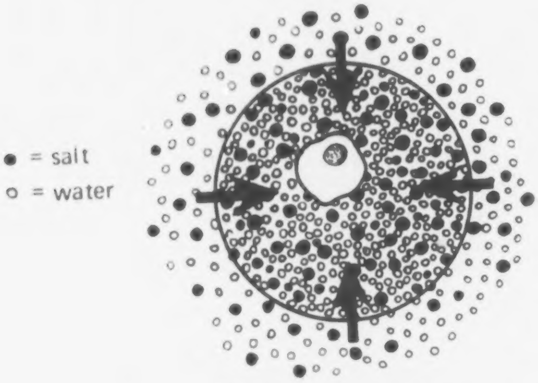

Specialized Structure
(Microvilli)
Cell
Nucleus
(see legend)
Cytoplasm
Cell
Membrane
Organelles
(see legend)
A
B
C
D
E
F
G
H
I
J
K

LEGEND	
A. Nuclear Membrane	G. Mitochondria
B. Nucleus	H. Vacuole
C. Nucleolus	I. Pinocytotic Vesicle
D. Endoplasmic Reticulum	J. Lysosome
E. Ribosome	K. Centriole
F. Golgi Complex	

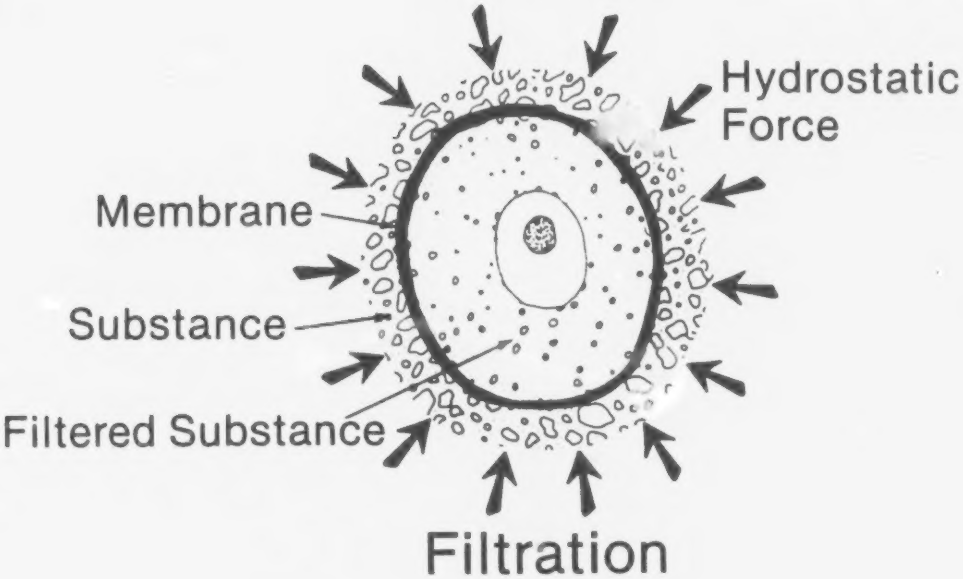
Passive Transport



Diffusion



Osmosis


Hydrostatic Force
Membrane
Substance
Filtered Substance

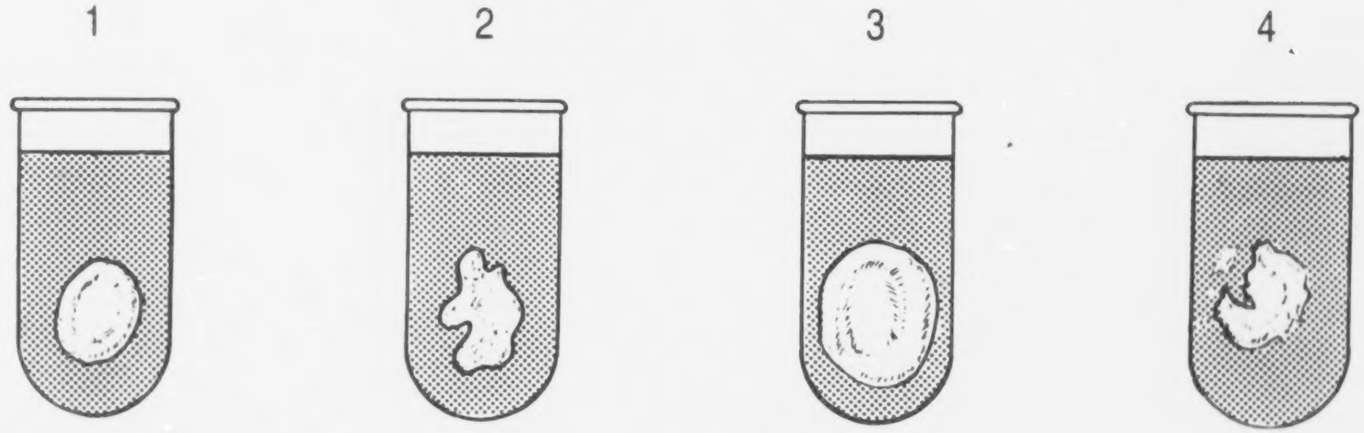
Filtration

Solutions

1 Isotonic Solution

2 Hypertonic Solution

3 and 4 Hypotonic Solutions



0.9% NaCL
NATURAL

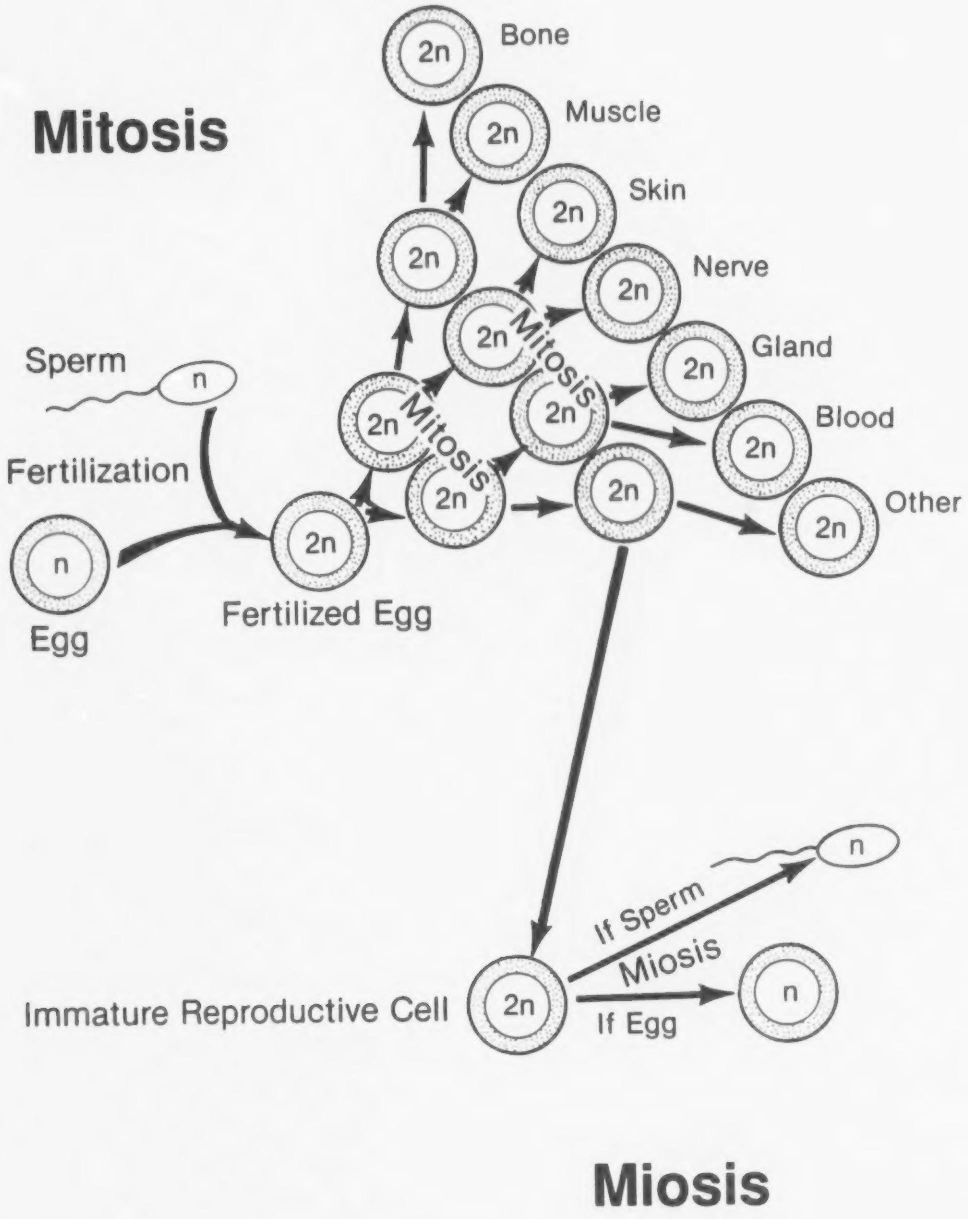
5.0% NaCL
SHRUNK

0.01% NaCL
ENLARGED

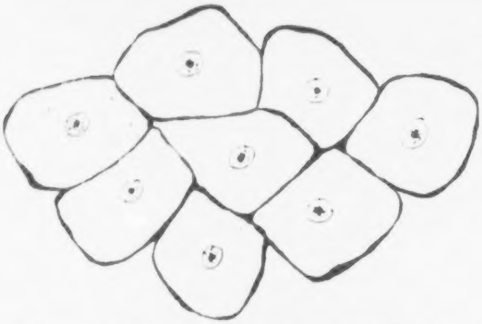
Distilled H_2O
BROKEN

Effect of Osmotic Pressure on Red Blood Cells

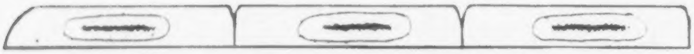
Mitotic and Miotic Cell Division


Mitosis
2n
Bone
2n
Muscle
2n
Skin
2n
Nerve
2n
Gland
2n
Blood
2n
Other
2n
2n
Mitosis
2n
Mitosis
2n
2n
2n
Sperm
n
Fertilization
n
Egg
2n
Fertilized Egg
n
If Sperm
Miosis
Immature Reproductive Cell
2n
If Egg
n
Miosis

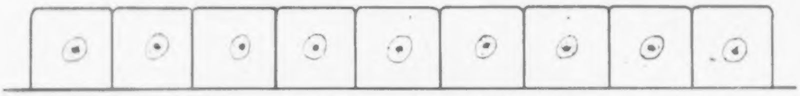
Epithelial Tissues



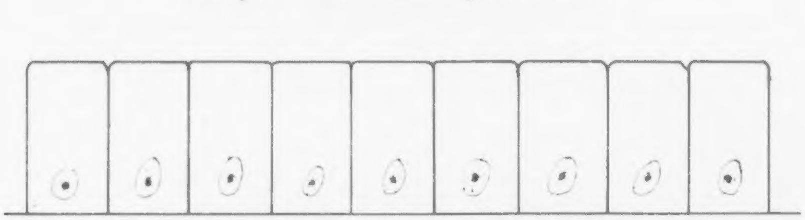
Simple Squamous Epithelium
(Surface View)



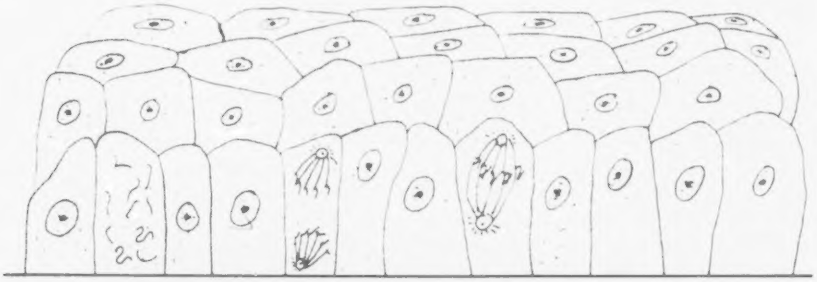
Simple Squamous Epithelium
--Line blood vessels, surface of pleura, peritoneum, and pericardium



Simple Cuboidal Epithelium

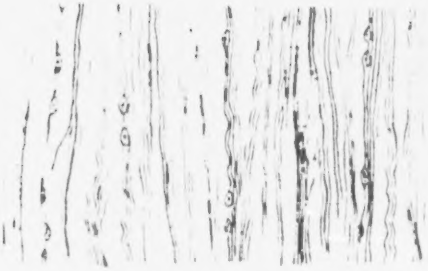


Simple Columnar Epithelium
--Line intestine, stomach, and part of respiratory tract

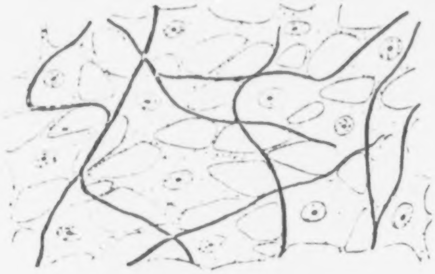


Stratified Squamous Epithelium
--Line mouth and esophagus; cover the body (skin)

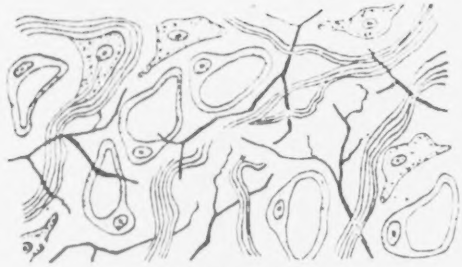
Connective Tissues



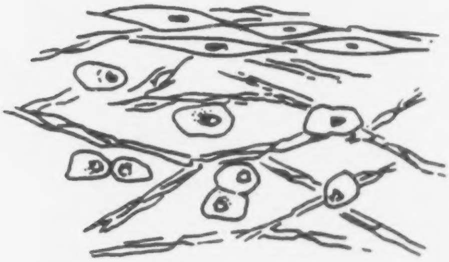
Fibrous



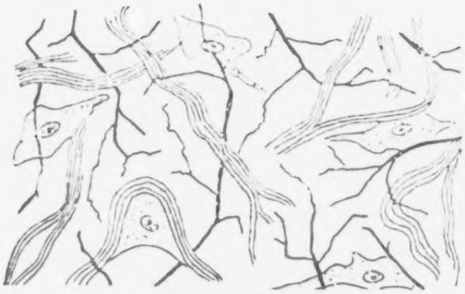
Reticular



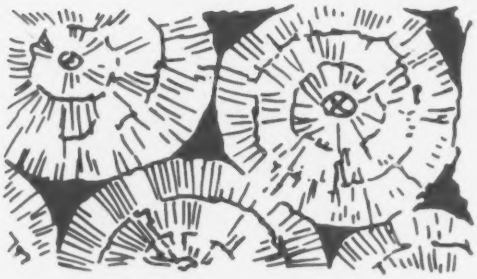
Adipose



Cartilage (Elastic)

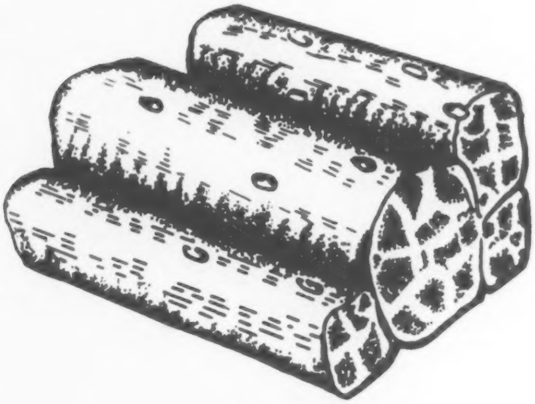


Areolar

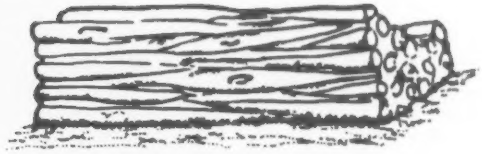


Bone (Osseous)

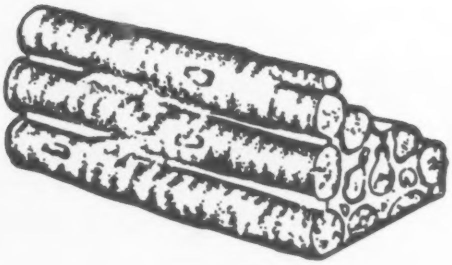
Muscle Tissues



Skeletal
(Striated)

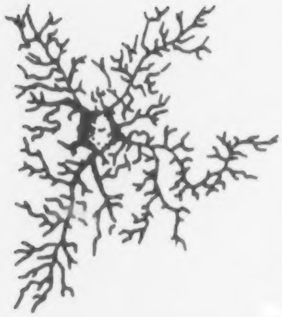


Visceral
(Nonstriated)

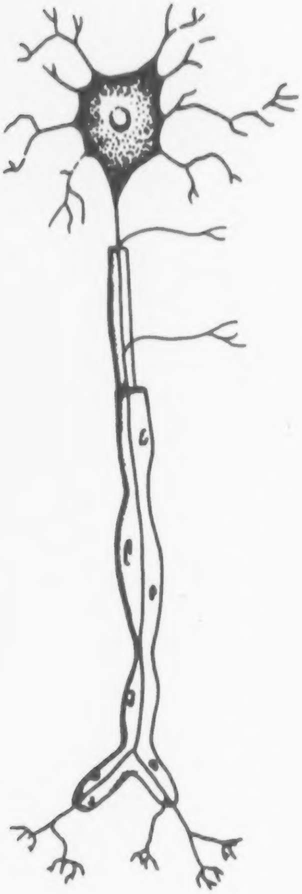


Cardiac
(Striated)

Nerve Tissues



Neuroglia



Neuron

Cells, Tissues, and Membranes
Unit 2

Information Sheet

1. **Terms and definitions**

   a. **Anabolism** — The constructive part of metabolism involving molecular synthesis

   b. **Body membrane** — A thin, soft pliable layer of tissue which lines or covers various parts of the body

   c. **Catabolism** — The destructive part of metabolism involving the release of energy and resulting in the breakdown of complex materials within the organism

   d. **Cell** — A small mass (usually microscopic) of protoplasm bound by a semipermeable membrane, usually including one or more nuclei and various nonliving products, which alone or interacting with others is capable of performing all the fundamental functions of life; the smallest structural unit of living matter capable of functioning independently

   e. **Cell membrane** — Surface layer of the cytoplasm of a cell

   f. **Cytology** — The study of the structure, function, multiplication, and pathology of cells

   g. **Electrolyte balance** — Condition that exists when the quantities of electrolytes entering the body equal those leaving it

   h. **Electrolytes** — Substances such as acids, bases, and salts which, in solution, conduct an electric current

   i. **Homeostasis** — A relatively stable state of equilibrium

   j. **Metabolism** — The process of continually building up and using protoplasm to carry on vital processes and activities

   k. **Nucleus** — The central structure of a cell enclosed in a membrane which is essential to cellular functions such as reproduction and protein synthesis

   l. **Protoplasm** — The living matter in all cells which is an organized complex of organic and inorganic substances which are too small for resolution with an ordinary light microscope

   m. **Semipermeable membrane** — A membrane which allows some molecules to pass through but not others

   n. **Tissue** — Group of similar cells arranged with intercellular substance between them specialized to perform a particular function

   o. **Vacuole** — A small cavity or space in cell protoplasm containing air or fluid

Information Sheet

2. **Compounds in protoplasm and their descriptions**

   a. **Water** — Most abundant compound in protoplasm that serves as the solvent in all cell chemistry

   Note: More than half of a cell is water.

   b. **Protein** — Second most abundant compound in animal protoplasm that forms the structural framework of protoplasm

   c. **Carbohydrates** — Serve as energy sources

   d. **Fats** — Serve as energy sources

   e. **Nucleic acids** — Control the growth and reproduction of the cells

   Note: There are two kinds of nucleic acid, deoxyribonucleic acid (DNA) which controls heredity, and ribonucleic acid (RNA) which transfers information from DNA to the protein-forming system of the cell.

   f. **Mineral salts** — Act as buffers in acid-base balance, maintain fluid and electrolyte balance, and aid in structure of the body

   Examples of minerals forming salts: Iron, iodine, calcium, phosphorus, sodium, chlorine, potassium

3. **Principal types of protoplasm**

   Note: An individual cell is composed of two principal kinds of protoplasm.

   a. **Nucleoplasm** — The protoplasm making up the cell's nucleus

   b. **Cytoplasm** — All the protoplasm not contained in the nucleus

4. **Major parts of a cell** (Figure 1)

   a. Cell nucleus

   b. Cell membrane

   c. Cytoplasm

   d. Organelles

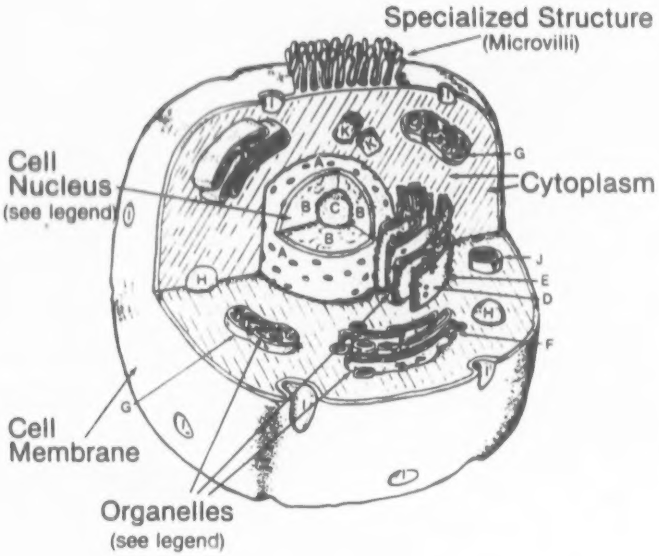
   Example: Mitochondria, ribosomes

   e. Specialized structures

   Example: Microvilli

Information Sheet

Figure 1—Parts of a cell


Specialized Structure
(Microvilli)
Cell
Nucleus
(see legend)
Cytoplasm
A
B
C
G
H
I
J
E
D
F
K
Cell
Membrane
Organelles
(see legend)

LEGEND	
A. Nuclear membrane	G. Mitochondria
B. Nucleus	H. Vacuole
C. Nucleolus	I. Pinocytotic vesicle
D. Endoplasmic reticulum	J. Lysosome
E. Ribosome	K. Centriole
F. Golgi complex	

5. Characteristics of the parts of a cell

a. Cell nucleus

(1) Regulates cellular structure and activities, including reproduction of the cell

(2) Parts of the nucleus

(a) Nuclear membrane — A thickening of the protoplasm around the edge of the nucleus which regulates the movement of materials in and out of the nucleus
(b) Chromosomes — Strands of DNA bearing the genes which carry the hereditary characteristics
(c) Nucleolus — A round, dense structure concerned with protein synthesis

Information Sheet

b. **Cell membrane**

  (1) Semipermeable outer wall of the cell which allows some molecules to pass through, but not others

  (2) Takes in fluid vacuoles through process of pinocytosis

C. **Cytoplasm**

  (1) A proteinaceous, semi-liquid, protoplasmic substance which lies within the cell membrane and surrounds the nucleus

  (2) Performs activities such as secretion and absorption

  (3) Contains many minute structures called organelles

d. **Organelles**

  (1) Serve in providing the cell's most basic function — The production of protein (for replacement of parts, for cell work, and for export as secretions)

  (2) Types of organelles

    (a) Endoplasmic reticula

      1) Layers of flattened vesicles which transport protein in various stages of construction
      2) Serve as the cells' own circulatory system

    (b) Golgi apparatus

      1) Appear like small sacs stacked on top of each other located near the nucleus
      2) Synthesize carbohydrates, combine them with protein, and package the produce — "Glycopackaging plant"

    (c) Mitochondria

      1) Appear like small, partitioned sausages
      2) Consist of two membranes forming a sac within a sac
        a) Outer smooth sac
        b) Inner partitioned sac has a number of folds known as cristae.
      3) Are rich in fats, proteins, and enzymes
      4) Produce energy for the cell through cellular respiration (utilization of oxygen and formation of carbon dioxide)
      5) Are known as the "power plants" for the cell

      Note: The amount of work required by the cell is directly related to the number of mitochondria the cell contains.

Information Sheet

(d) Lysosomes

1) Membranous, saclike containers of enzymes
2) Digest and disintegrate the contents of the vacuole

(e) Ribosomes

1) Small, spherically-shaped organelles attached to the rough endoplasmic reticulum or scattered throughout the cell
2) Contain RNA and protein
3) Synthesize protein
4) Are called "protein factories"

(f) Centrosomes

1) Located near the center of the cell
2) Contain two tiny cylinders called centrioles, which play a part in forming the spindle which appears during mitosis

e. **Specialized structures**

(1) Microvilli

(a) Special structures of the epithelial cells which line the intestines
(b) Consist of extension of cytoplasm and cytoplasmic membrane
(c) Increase the surface area of the cell

(2) Cilia

(a) Tiny, hairline projections which are found on the epithelial cells forming the surface of the mucous membrane lining parts of the respiratory tract

Note: A cell may contain many cilia.

(b) Propel a fluid in one direction over the surface of the cell

(3) Flagellum

(a) Single, hairlike projection from the surface of a cell which propels it
(b) A spermatozoon contains a flagellum to propel it through the seminal fluid

Information Sheet

6. **Functions of a cell**

   a. Move substances into and out of the cell

   b. Metabolize nutrients

   c. Consume oxygen

   d. Release energy

   e. Synthesize proteins

   f. Reproduce itself

   g. Perform function specific to that cell

7. **Active and passive transport of material through a cell membrane**

   a. **Active transport** — Requires energy from the cell or wraps itself around a foreign particle

   b. **Passive transport** — Requires no energy from the cell; moves through solution methods of movement

8. **Types of active transport and their descriptions**

   a. **Physiological pump** — Moves molecules or ions through cell membranes in an uphill direction, making their concentration gradients go up, against their natural tendency

   b. **Phagocytosis** (eating cell action) — The process of engulfing a *solid* particle by forming a pocket with the cell membrane, pinching off from the rest of the membrane, and migrating into the cell as a closed vacuole

   c. **Pinocytosis** (drinking cell action) — The process of engulfing a *liquid* particle by forming a pocket with the cell membrane, pinching off from the rest of the membrane, and migrating into the cell as a closed vacuole

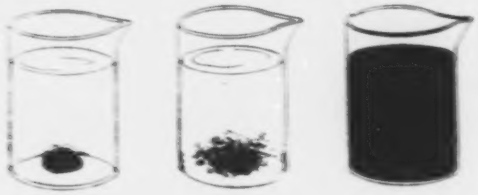
Information Sheet

9. Types of passive transport and their descriptions

a. **Diffusion** — Particles move to equalize concentration throughout.

Example: Dispersion of carbon dioxide and oxygen to areas of lesser concentration through the membrance of the lung

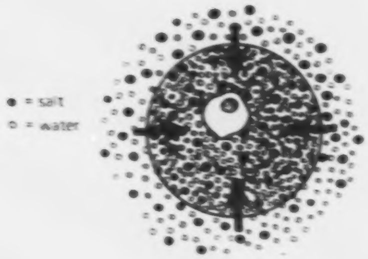
Figure 2—Diffusion



b. **Osmosis** — Solvent molecules pass through a semi-permeable membrane to equalize concentration on each side.

Example: When there is an increase in the amount of salt in tissue fluid, water moves into the tissues to lower the salt concentration.

Figure 3—Osmosis

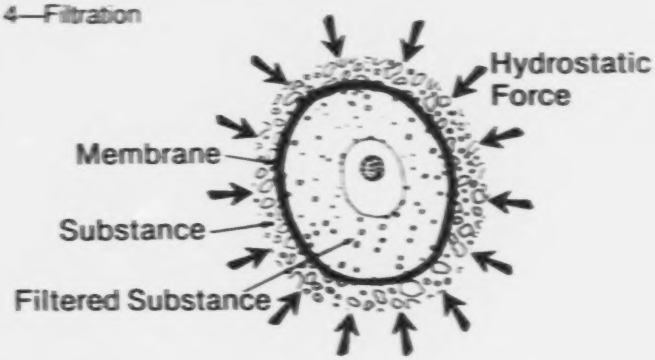


Information Sheet

c. **Filtration** — Particles move through a filter or membrane that prevents passage of certain molecules.

Examples: The spleen filters the blood, removing wastes, old red cells, and foreign substances.

Figure 4—Filtration



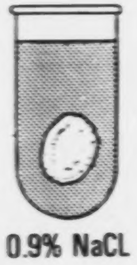
10. Types of solutions and their descriptions

a. **Isotonic solution** — Has the *same* concentration of dissolved particles as the solution with which it is compared

Note: This solution is also know as normal solution.

Example: Red blood cells normally exist in a 0.9 percent salt solution with the same concentration of salt in the outside solution.

Figure 5—Isotonic solution



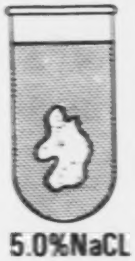
Note: Red blood cell appears natural in this solution.

Information Sheet

b. **Hypertonic solution** — Condition in which a solution contains a *greater* concentration of dissolved particles than the solution with which it is compared.

Example: If the solution outside the cell contains a higher content of salt, then osmosis takes place and water flows out of the cell, causing it to shrink and be destroyed (crenation).

Figure 6—Hypertonic solution

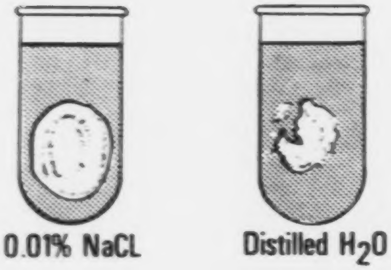


Note: Red blood cell appears shrunk in this solution.

c. **Hypotonic solution** — Condition in which a solution contains a *lesser* concentration of dissolved particles than the solution with which it is compared.

Example: If the solution outside the cell contains a lower content of salt than normal, osmosis takes place and water flows into the cell. This makes the cell swell and can cause rupture (hemolysis).

Figure 7—Hypotonic solution



Note: Red blood cell enlarges and may break apart.

Information Sheet

11. **Types of cellular reproduction** (Figure 8)

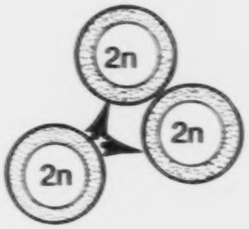
a. **Mitosis**

(1) Occurs in all human cells except reproductive cells and nerve tissue cells

(2) Gives rise to two daughter cells which are identical to parent cell

(3) Takes place in four stages: prophase, metaphase, anaphase, and telophase

Figure 8—Mitosis



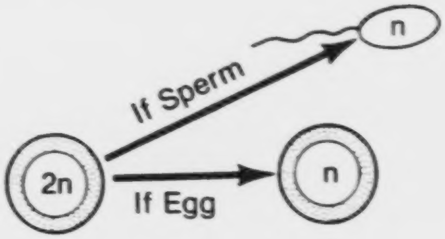
b. **Miosis**

(1) Occurs in reproductive (sex) cells

(2) Gives rise to four daughter cells which contain only half the number of chromosomes found in parent cell

Note: The reproductive cells (sperm and ovum) must undergo miosis instead of mitosis in order to contain only half the total number of chromosomes. Consequently, when the sperm and ovum unite, the total number of chromosomes contained will be 46.

Figure 9—Miosis



Information Sheet

12. **Basic types of tissues and their functions**

    a. **Epithelial** — Acts as a protective barrier from heat, cold, water loss, and bacterial invasion; aids in secretion and excretion

    b. **Connective** — Protects, supports, transports, and binds the body together

    Note: This is the most widespread tissue in the body.

    c. **Muscle** — Moves body by contraction/relaxation of muscle pairs

    d. **Nerve** — Conducts impulses throughout the body

13. **Characteristics of epithelium**

    a. Covers the body and many of its parts

    b. Lines the body's serous cavities, blood and lymph vessels, and the respiratory, digestive, and urinary tracts

    c. Forms the body's glands

    d. Has close cellular arrangement with very little intercellular substance

    e. Contains no blood vessels; receives oxygen and nutrients by diffusing upward from capillaries of the connective tissue which always lies underneath the epithelium

    f. Has a basement membrane which lies between the epithelial and connective tissue

    g. Undergoes mitosis continually to replace the upper layer of cells which are lost to normal wear and tear

Information Sheet

14. **Classifications of epithelium** (Figure 10)

    a. By the shape of the cells

        (1) Squamous — Flat and scalelike

        (2) Cuboidal — Cubelike

        (3) Columnar — Taller or longer than they are wide

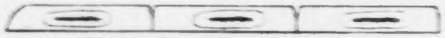
    b. By the layer arrangement

        (1) Simple — A single layer

        (2) Stratified — Multiple layers

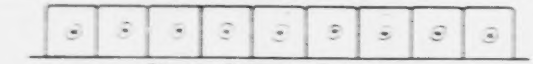
        Examples: Simple squamous, stratified squamous

Figure 10—Epithelial tissues

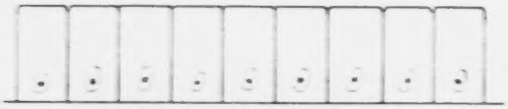


Simple Squamous Epithelium

-Line blood vessels, surface of pleura, peritoneum, and pericardium

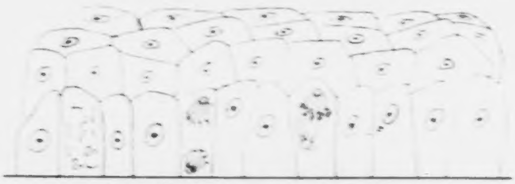


Simple Cuboidal Epithelium



Simple Columnar Epithelium

-Line intestine, stomach, and part of respiratory tract



Stratified Squamous Epithelium

-Line mouth and esophagus; cover the body (skin)

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Information Sheet

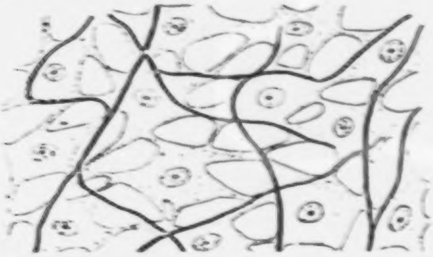
15. **Types of connective tissues**

a. **Reticular**

(1) Location — Spleen, lymph nodes, and bone marrow

(2) Function — Filters injurious substances from blood and lymph by the reticular network; phagocytosis

Figure 11—Reticular

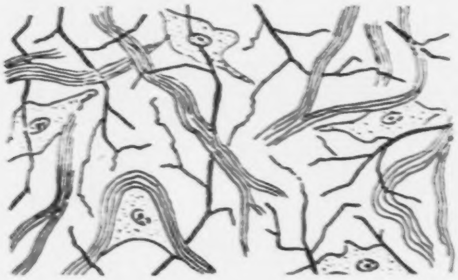


b. **Areolar** (loose, ordinary)

(1) Location — Between other tissues, organs, and superficial tissues

(2) Function — Connects tissues

Figure 12—Areolar

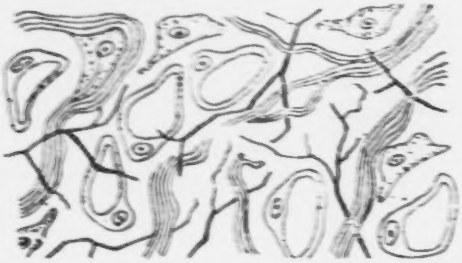


c. **Adipose** (fat)

(1) Location — Under skin as padding

(2) Function — Protects, insulates, supports, and acts as reservoir for food

Figure 13—Adipose

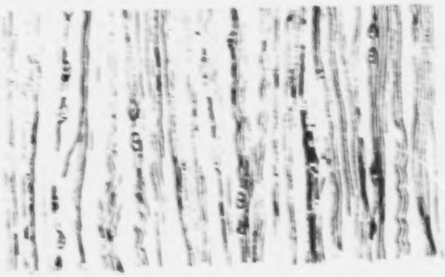


d. **Fibrous**

(1) Location — Tendons, ligaments, deep fascia, dermis, scars, capsule of kidney

(2) Function — Flexible, but strong connecting tissue

Figure 14—Fibrous



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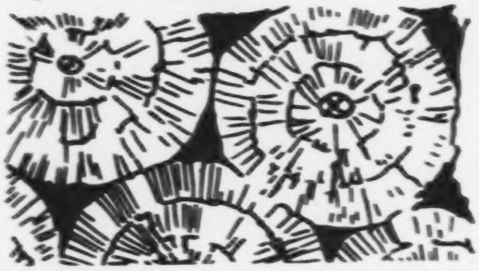
e. **Bone** (osseous)

(1) Location — Skeleton

(2) Function — Protects, supports

Figure 15—Bone

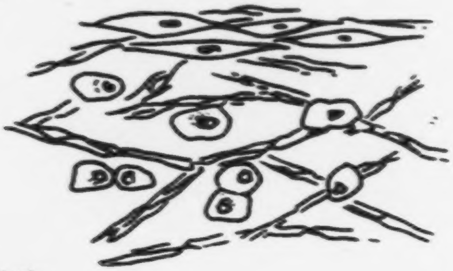


f. **Cartilage** (elastic)

(1) Location — Nasal septum, covering surfaces of bones, larynx rings in trachea, and bronchi vertebral discs, external ear, eustachian tube

(2) Function — Firm, but flexible support

Figure 16—Cartilage



g. **Hemopoietic**

(1) Location

- (a) Myeloid — Bone marrow
- (b) Lymphatic — Lymph nodes, spleen, tonsils, and thymus

(2) Function

- (a) Myeloid — Formation of red and white blood cells and platelets
- (b) Lymphatic — Formation of lymphocytes and monocytes

Information Sheet

h. **Blood**

(1) Location — Blood vessels

(2) Function — Transportation, protection

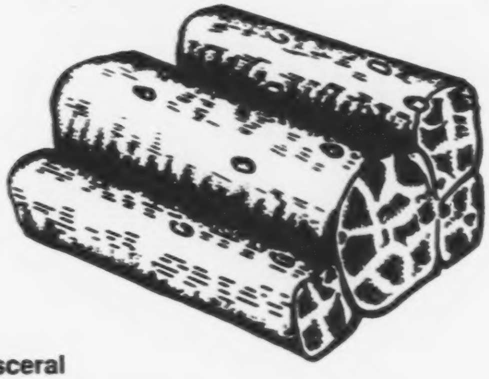
16. Types of muscle tissue

a. **Skeletal**

(1) Striated, voluntary

(2) Attached to bones

Figure 17—Skeletal

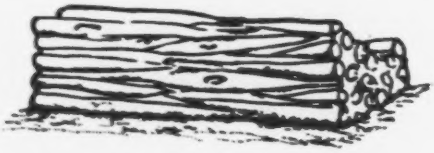


b. **Visceral**

(1) Nonstriated, smooth, involuntary

(2) Found in walls of hollow organs such as blood vessels, intestines, and uterus

Figure 18—Visceral



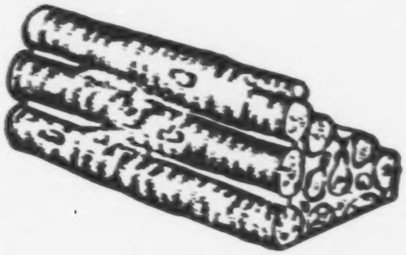
Information Sheet

c. **Cardiac**

(1) Striated, involuntary

(2) Composes the walls of the heart

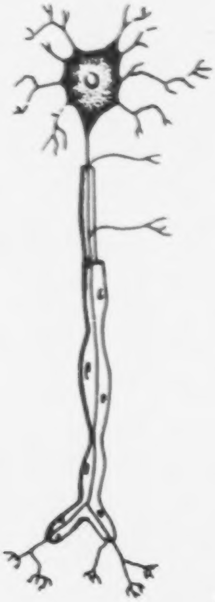
Figure 19—Cardiac



17. **Types of nerve tissue**

a. **Neuron** (the nerve cell)

Figure 20—Neuron

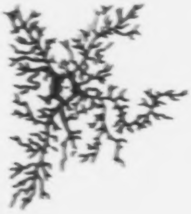


Information Sheet

b. **Neuroglia** (Interstitial connective tissue)

Note: Nervous tissue is located in the brain, spinal cord, and nerves.

Figure 21—Neuroglia



18. Main types of membranes

a. **Mucous membranes**

(1) Line cavities or passages of the body that open to the exterior such as mouth, esophagus, digestive tract, respiratory passages, and GU tract

(2) Consist of epithelial tissue over connective tissue

(3) Function in protection, secretion of mucus, and absorption

b. **Serous membranes**

(1) Line closed cavities of the body such as thoracic cavity (pleura), abdominal cavity (peritoneum), and sac in which heart lies (pericardium)

(2) Also cover organs lying in those closed cavities

(3) Have two layers

(a) Visceral layer — Covers the organs
(b) Parietal layer — Lines the cavity

(4) Potential space between the two layers is kept moist by the secretion of a small amount of serous fluid which prevents friction when the two layers rub together.

c. **Synovial membranes**

(1) Line joint, tendons, and bursae

(2) Secrete synovial fluid which prevents friction on the smooth, moist surfaces

Information Sheet

d. **Cutaneous membranes** (the skin)

  (1) Cover the body

  (2) Are continuous with mucous membranes

  (3) Have essentially two layers

    (a) Epidermis — Outer layer
    (b) Dermis — Under layer

    Note: The skin will be covered in detail in Unit 3, "Integumentary System."

Cells, Tissues, and Membranes
Unit 2

Student Supplement 1—Identify Parts of a Cell

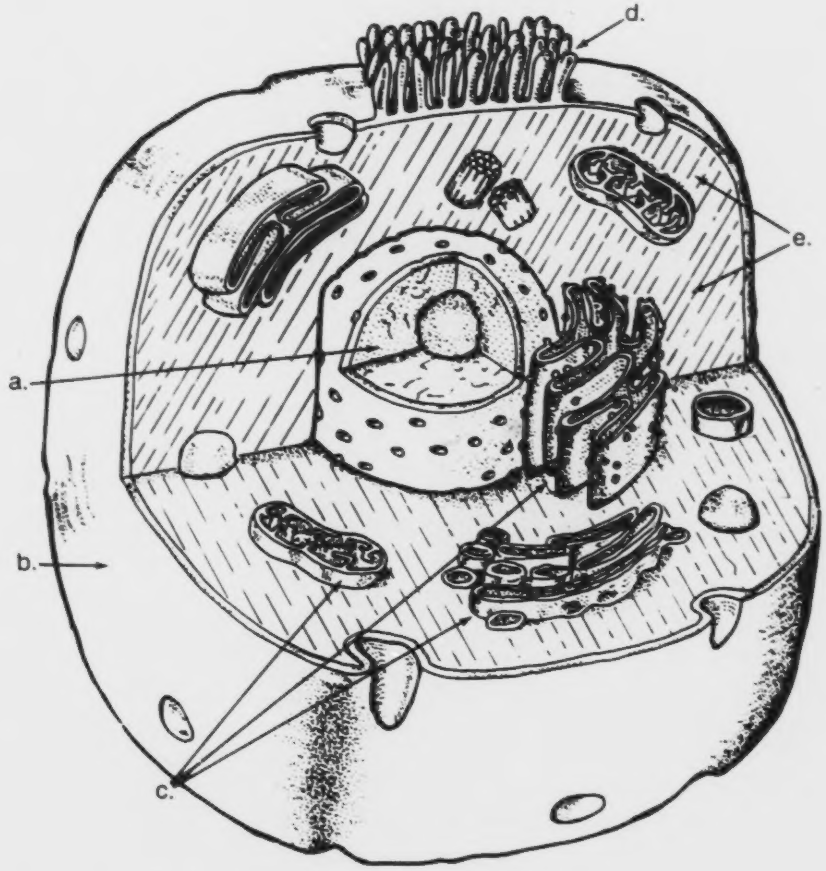
Name ____

Directions: Identify the parts of the cell shown in the following illustration. Place your answers in the blanks provided.

a. ________________________________ d. ______________________________

b. ________________________________ e. ______________________________

c. ________________________________



Cells, Tissues, and Membranes
Unit 2

Student Supplement 2—Complete Statements Concerning the Cell

Name ____

Directions: Select the *best* answers which complete the following statements or questions. Place your answers in the blanks provided.

_____ 1. A single, hairlike projection from the surface of a cell such as a spermatozoon is called a:

- a. Cilia
- b. Microvilli
- c. Chromosome
- d. Flagellum

_____ 2. Cytoplasm is one principal type of:

- a. Protoplasm
- b. Blood
- c. Nucleoplasm
- d. Enzyme

_____ 3. All of the following are functions of a cell **EXCEPT**:

- a. Produce oxygen
- b. Reproduce itself
- c. Metabolize nutrients
- d. Synthesize proteins

_____ 4. Pinocytosis is the process of engulfing a ________________ particle as a closed vacuole.

- a. Salt
- b. Solid
- c. Liquid
- d. Gaseous

_____ 5. Mitosis gives rise to ______________ daughter cells which ______________ the parent cell.

- a. Four, are identical to
- b. Two, are identical to
- c. Four, contain half the number of chromosomes as
- d. Two, contain half the number of chromosomes as

Student Supplement 2

______ 6. The most abundant compound in protoplasm is:

a. Water
b. Fats
c. Carbohydrates
d. Protein

______ 7. All of the following are types of organelles **EXCEPT**:

a. Mitochondrion
b. Ribosomes
c. Chromosomes
d. Lysosomes

______ 8. Which of the following are called the "power plants" for the cell?

a. Cell membranes
b. Lysosomes
c. Centrosomes
d. Mitochondrion

______ 9. All of the following are examples of passive transport **EXCEPT**:

a. Filtration
b. Phagocytosis
c. Osmosis
d. Diffusion

______10. The study of cells is called:

a. Hematology
b. Biology
c. Cystiology
d. Cytology

Cells, Tissues, and Membranes
Unit 2

Student Supplement 3—Complete Statements Concerning Tissues and Membranes

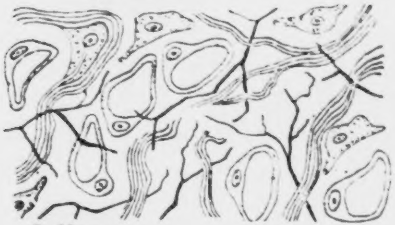
Name ______________________________________

Directions: Select the *best* answers which complete the following statements or questions. Place your answers in the blanks provided.

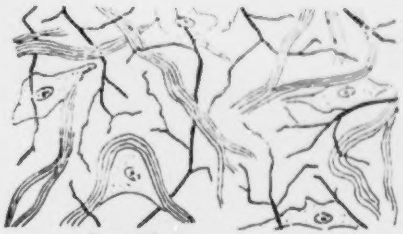
Part A—Tissues

______ 1. The following illustrations are examples of ________________ tissue.

a. Muscle
b. Nerve
c. Connective
d. Epitheiial



Adipose



Areolar

______ 2. The type of tissue which conducts impulses throughout the body is called ________________ tissue.

a. Epithelial
b. Connective
c. Muscle
d. Nerve

______ 3. What type of tissue always lies underneath the epithelium?

a. Connective
b. Skeletal
c. Nerve
d. Visceral

______ 4. Stratified squamous epithelial tissue is defined as ________________ tissue.

a. Single layer, flat
b. Single layer, cubelike
c. Multiple layer, flat
d. Multiple layer, cubelike

Student Supplement 3

______ 5. What type of connective tissue filters injurious substances from blood and lymph and is located in the spleen, lymph nodes, and bone marrow?

a. Fibrous
b. Areolar
c. Reticular
d. Cartilage

______ 6. Cardiac muscle tissue can be defined as:

a. Striated, voluntary
b. Striated, involuntary
c. Nonstriated, voluntary
d. Nonstriated, involuntary

______ 7. The type of connective tissue which protects, insulates, supports, and acts as a reservoir for food is called ______________ tissue.

a. Areolar
b. Reticular
c. Cutaneous
d. Adipose

Part B—Membranes

______ 8. Cutaneous membranes cover:

a. The joints
b. The body
c. The organs
d. The tendons

______ 9. Which type of membrane lines the cavities or passages of the body that open to the exterior?

a. Mucous
b. Serous
c. Synovial
d. Cutaneous

______ 10. Serous membranes line all of the following cavities **EXCEPT**:

a. Oral
b. Thoracic
c. Abdominal
d. Pericardium

Cells, Tissues, and Membranes
Unit 2

Assignment Sheet 1—Demonstrate the Transport Movements of Materials

Name ______________________________ Overall Rating __________

Evaluation criteria	**Rating**
Experiments are performed correctly	______
Descriptions and conclusions are well-written and clearly stated	______

Introduction: The active and passive transport movement of liquids and solids is a constant process throughout the body within each cell. To understand how these materials move helps in assessing patient homeostasis. The experiments below will help you to understand each passive transport method.

Directions: Perform each experiment with the equipment and materials required. Answer the questions that follow.

Materials needed: Drinking glasses or beakers (4); water; rubber band; dialysis tubing or animal membrane; funnel; brown table syrup; tablet of dye (such as Easter egg dye); food coloring; clock, stop watch, or timer; dirt; strainer; tissue or paper towel

1. Fill a glass partially full of water. Use a rubber band to fasten a piece of dialysis tubing or animal membrane over the bottom of a funnel. Pour brown table syrup into the funnel. Set the funnel in the glass. The bottom of the funnel should be below the level of the water. Observe the two solutions. What happened to them? Why? What is this movement called?

   ____

   ____

   ____

   ____

   ____

Assignment Sheet 1

2. Drop a tablet of dye, such as Easter egg dye, in one glass of water and a drop of food coloring in another glass of water. Record the starting and ending times of the experiment using a clock, stop watch, or timer. Which glass of water became evenly colored in the shorter length of time? Why? What is this movement called?

3. Prepare a mixture of dirt in water. Line a strainer, such as a tea strainer, with a piece of tissue or paper towel. Pour the dirt and water mixture through the lined strainer. What happened? Is the water clear or cloudy after it passes through the tissue? Why? What is this movement called?

Integumentary System
Unit 3

Objective Sheet

Unit Objective

After completing this unit, the student should be able to select characteristics and functions of the skin, identify parts of the skin, and match layers of the skin with the correct descriptions. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the integumentary system with their correct definitions.
2. Select from a list characteristics of the skin.
3. Distinguish between the two main layers of the skin.
4. Match layers of the epidermis with the correct descriptions.
5. Distinguish between the layers of the dermis.
6. Complete statements concerning the accessory appendages of the skin.
7. Select from a list functions of the skin.
8. Match disorders and abnormalities of the skin with the correct definitions.

Integumentary System
Unit 3

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make a transparency from the transparency master included with this unit. This appears in the teacher edition only and is designed to be used with the following objective:

   TM 1—The Skin (Objective 3)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplement. This could be used as a homework assignment, daily practice exercise, or quiz. Explain to students how you plan to evaluate the supplement, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Show available films concerning the integumentary system and its appendages.

2. Discuss various anomalies of the skin.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.

2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.

3. Jacob, Stanley W., and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.

4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Videotapes

    a. *I Am Joe's Skin*, part of the *I Am Joe's* Series available from several sources. Two companies offering this series include the following:

    (1) Medcom/Trainex
    Box 3225
    Garden Grove, CA 92641
    800-877-1443

    (2) Pyramid Film and Video
    P.O. Box 1048
    Santa Monica, CA 90406-1048
    800-421-2304

    b. *Skin Deep*, part of *The Living Body* Series available from:

    Films for the Humanities and Sciences
    P.O. Box 2053
    Princeton, NJ 08543-2053
    800-257-5126 or 609-452-1128

2. Software—*Connective Tissues and Skin* (Module 2), part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

    Health Sciences Consortium
    201 Silver Cedar Court
    Chapel Hill, NC 27514-1517
    919-942-8731

Integumentary System
Unit 3

Answers to Student Supplement 1

a. Dermis
b. Epidermis
c. Cutaneous layer
d. Hair shaft
e. Sebaceous gland
f. Hair root in follicle
g. Sweat gland
h. Nerve

Integumentary System
Unit 3

Answers to Written Test

1. a. 3
   b. 6
   c. 8
   d. 11
   e. 5
   f. 9
   g. 7
   h. 10
   i. 2

2. a, c, d

3. b, e, f, g

4. a. 5
   b. 1
   c. 3
   d. 2
   e. 4

5. c, d, e

6. a. (1) Shaft
   (2) Dermis
   (3) Sebum
   (4) One-half
   (5) Follicle
   b. (1) Epithelial
   (2) Hangnail
   c. (1) Sebaceous
   (2) Decrease
   (3) Sweat
   (4) External
   (5) 3,000

7. c, d, e, g, h

8. a. 6
   b. 3
   c. 10
   d. 1
   e. 4
   f. 11
   g. 5
   h. 9
   i. 7

Integumentary System
Unit 3

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______a. A branch of science dealing with the skin, its structures, functions, and diseases

______b. Something that covers or encloses as an enveloping layer such as skin or a membrane

______c. The space within a tube, artery, vein, or intestine

______d. Relating to the sense of touch

______e. The outer, nonsensitive, nonvascular layer of the skin

______f. The dark brown or black pigment that gives color to hair and skin

______g. An extremely tough protein substance in hair, nails, and horny tissue

______h. A fatty, oil secretion of the sebaceous glands of the skin

______i. Wax-like soft brown secretion found in the external canal of the ear

1. Appendage
2. Cerumen
3. Dermatology
4. Dermis
5. Epidermis
6. Integument
7. Keratin
8. Lumen
9. Melanin
10. Sebum
11. Tactile

2. Select characteristics of the skin by placing an "X" next to the correct characteristics.

______a. Largest organ of the body

______b. Is consistent in depth

______c. The body's first line of protection against disease

______d. Continuous with the mucous membrane

______e. Color depends upon deposits of varying amounts of melanin and upon changing amounts of sebum supplied to the skin

Written Test

3. Distinguish between the two main layers of the skin by placing an "X" next to characteristics of the epidermis.

______ a. Composed of dense, fibrous connective tissue

______ b. Thickness varies in different parts of the body

______ c. Contains all accessory appendages

______ d. Has two layers

______ e. Has no blood or lymph vessels or nerve endings

______ f. Composed of stratified, squamous epithelial tissue

______ g. Has four layers of cells except on the palms of hands and soles of feet where there are five

______ h. Contains nerve endings for five types of sensations—heat, cold, pain, touch or tactile, and pressure

4. Match the layers of the epidermis on the right with the correct descriptions.

______ a. Top layer where dead cells converted into keratin continually flake off

______ b. Layer only found in palms or soles

______ c. Layers where cells die and granules are present in the cytoplasm

______ d. Layer of irregularly shaped cells

______ e. Bottom layer where columnar shaped cells undergo mitosis continually to make new cells and to push old ones upward

1. Stratum lucidum
2. Stratum spinosum
3. Stratum granulosum
4. Stratum germinativum
5. Stratum corneum

Written Test

5. Distinguish between the layers of the dermis by placing an "X" next to characteristics of the papillary layer.

______a. Forms a network of interlacing cells and fibers

______b. Lies beneath papillary layer

______c. Produces the familiar ridges of the skin which form a characteristic and unchangeable pattern of every individual

______d. Elevated into tiny projections

______e. Lies next to the germinal (basal) layer of epidermis

6. Complete the following statements concerning the accessory appendages of the skin by circling the correct answers.

a. Hair

(1) Hair (follicle, shaft) is the visible part of the hair.

(2) Hair root is the part of the hair that is embedded in the (bone, dermis).

(3) Hair is kept soft and pliable by two or more sebaceous glands which secrete (cerumen, sebum).

(4) Hair grows about (one-fourth, one-half) inch a month.

(5) A boil or furuncle is an infection of a hair (follicle, root).

b. Nails

(1) Grow from (epidermal, epithelial) cells lying under the white crescent at the proximal end of the nail.

(2) Paronychia is a (vesicle, hangnail) around the fingernail.

c. Skin glands

(1) (Sweat, Sebaceous) glands secrete sebum to lubricate the hair.

(2) Sebaceous glands (decrease, increase) the amount of heat lost from the skin.

(3) (Ceruminous, Sweat) glands consist of tubes coiled into a tiny ball surrounded by capillaries.

(4) Ceruminous glands are located in (internal, external) ear canals.

(5) A single square inch of skin on the palms of the hand contains (300, 3,000) sweat glands.

Written Test

7. Select functions of the skin by placing an "X" next to the correct functions.

______a. Absorbs and stores heat from sunlight for use by body

______b. Determines size and weight of an individual

______c. Senses pain, heat, cold, touch, and pressure through nerve endings in the skin

______d. Aids in maintaining fluid and electrolyte balance

______e. Acts as excretory organ

______f. Sends blood to heart to maintain blood pressure

______g. Regulates body temperature by varying the amount of blood flowing through the skin and varying the amount of sweat excretion

______h. Protects by acting as a mechanical barrier against microorganisms, sunlight, and chemicals

8. Match the disorders and abnormalities of the skin on the right with the correct definitions.

______a. Infection and inflammation of sebaceous glands

______b. Sudden appearance of raised patches which are usually redder than the surrounding skin, often accompanied by severe itching, and usually caused by allergic reaction, infection, or stress

______c. Pressure sores on the body which are frequently found on the sacrum, elbows, and heels

______d. Inflammation and infection of the dermis and subcutaneous tissue caused by bacteria which enter through hair follicles

______e. A blister

1. Boils
2. Fissure
3. Hives
4. Vesicle
5. Polyp
6. Acne
7. Cyst
8. Ulcer
9. Pustule
10. Decubitus ulcers
11. Nodule

Written Test

______f. A small node which is solid and irregular in form

______g. A growth extending into the lumen of a mucous membrane or appearing on the skin

______h. An elevation filled with pus

______i. A sac which contains any fluid-like substance besides pus

***Permission to duplicate this test is granted.**

Integumentary System
Unit 3

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest ______ Posttest ______ Other ______

Other ____

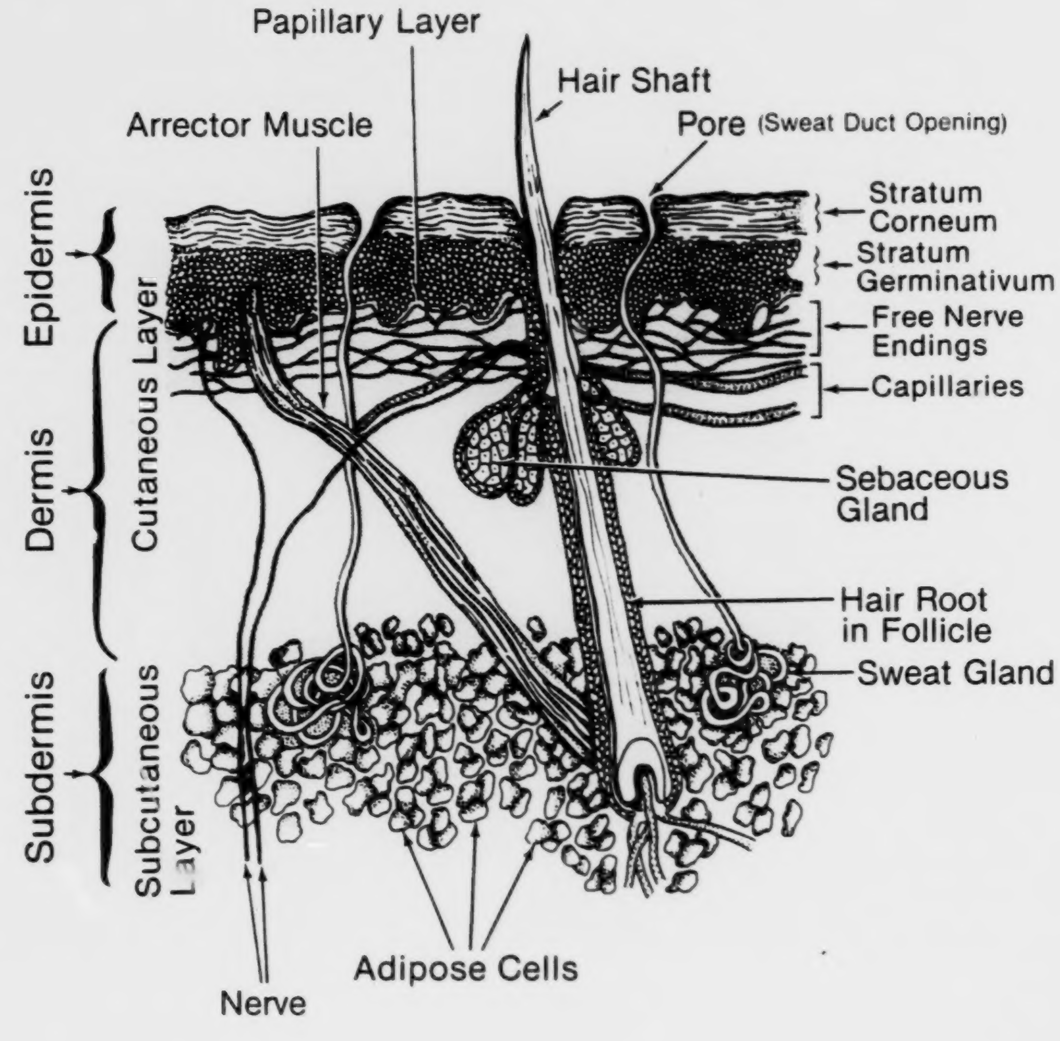
____

Teacher Signature ______________________________ Date __________

Student Signature ______________________________ Date __________

***Permission to duplicate this form is granted.**

The Skin


Papillary Layer
Hair Shaft
Arrector Muscle
Pore (Sweat Duct Opening)
Stratum Corneum
Stratum Germinativum
Free Nerve Endings
Capillaries
Sebaceous Gland
Hair Root in Follicle
Sweat Gland
Epidermis
Dermis
Subdermis
Cutaneous Layer
Subcutaneous Layer
Adipose Cells
Nerve

Integumentary System
Unit 3

Information Sheet

1. **Terms and definitions**

    a. **Appendage** — Anything attached to a larger or major part

    b. **Cerumen** — Wax-like soft brown secretion found in the external canal of the ear

    c. **Dermatology** — A branch of science dealing with the skin, its structures, functions, and diseases

    d. **Dermis** — The inner, sensitive, vascular layer of the skin

    e. **Epidermis** — The outer, nonsensitive, nonvascular layer of the skin

    f. **Integument** — Something that covers or encloses as an enveloping layer such as skin or a membrane

    g. **Keratin** — An extremely tough protein substance in hair, nails, and horny tissue

    h. **Lumen** — The space within a tube, artery, vein, or intestine

    i. **Melanin** — The dark brown or black pigment that gives color to hair and skin

    j. **Sebum** — A fatty, oil secretion of the sebaceous glands of the skin

    k. **Tactile** — Relating to the sense of touch

2. **Characteristics of the skin (cutaneous membrane)**

    a. Largest organ of the body

    b. Varies in depth

    c. The body's first line of protection against disease (if it is kept clean)

    d. Continuous with the mucous membrane (which lines cavities that communicate with the exterior)

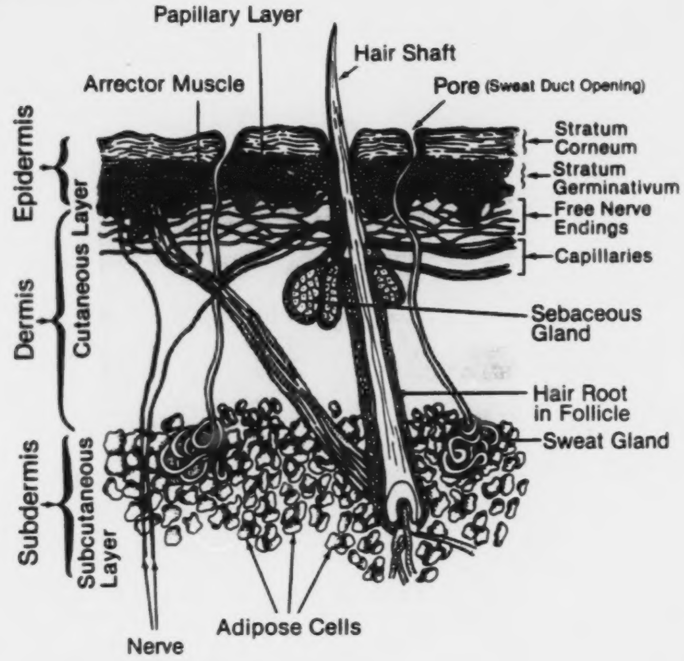
    e. Color depends upon deposits of varying amounts of melanin and upon changing amounts of blood supplied to the skin.

    Note: The larger the deposits of melanin, the darker the skin. The color of skin is mainly determined by genetic effect.

Information Sheet

3. Two main layers of skin

Figure 1—The skin


Papillary Layer
Hair Shaft
Arrector Muscle
Pore (Sweat Duct Opening)
Stratum Corneum
Stratum Germinativum
Free Nerve Endings
Capillaries
Sebaceous Gland
Hair Root in Follicle
Sweat Gland
Epidermis
Dermis
Subdermis
Cutaneous Layer
Subcutaneous Layer
Nerve
Adipose Cells

a. **Epidermis** or "false skin" — The thinner, outer surface layer

(1) Composed of stratified, squamous epithelial tissue

(2) Is protective and the greater part of its thickness is made up of dead epithelial cells that are continually being scraped off and replaced by underlying daughter cells

(3) Thickness varies in different parts of the body.

(a) Thickest on soles of feet
(b) Thinnest on eyelids, forehead, and penis

(4) Has no blood or lymph vessels or nerve endings (nonvascular and nonsensitive)

(5) Has four layers of cells except on the palms of hands and soles of feet where there are five

Information Sheet

b. **Dermis** (corium) or "true skin" — Lies underneath the epidermis

   (1) Composed of dense, fibrous connective tissue

   (2) Blood capillaries and nerves pass freely through the dermis to supply the epidermis.

   (3) Contains nerve endings for five types of sensations

      (a) Heat
      (b) Cold
      (c) Pain
      (d) Touch
      (e) Pressure

   (4) Contains all accessory appendages of the skin

   Examples: Hair, sweat glands

   (5) Has two layers

4. **Layers of the epidermis and their descriptions**

   a. **Stratum corneum** (horny layer) — Top layer where dead cells converted into keratin continually flake off

   b. **Stratum lucidum** (translucent or clear layer) — Layer only found in palms or soles

   c. **Stratum granulosum** (granular layer) — Layers where cells die and granules are present in the cytoplasm

   d. **Stratum spinosum** (prickle cell layer) — Layer of irregularly shaped cells

   e. **Stratum germinativum** (basal layer) — Bottom layer where columnar shaped cells undergo mitosis continually to make new cells and to push old ones upward

5. **Layers of the dermis**

   a. **Papillary layer**

      (1) Elevated into tiny projections (papillae) and hollows

      (2) Lies next to the germinal (basal) layer of epidermis

      (3) Produces the familiar ridges of the skin which form a characteristic and unchangeable pattern for every individual

      Note: This is why finger or foot printing is available for positive identification.

Information Sheet

b. **Reticular layer**

(1) Lies beneath papillary layer

(2) Forms a network of interlacing cells and fibers

6. **Accessory appendages of the skin**

a. **Hair**

(1) Found on all parts of the body except the palms of hands, soles of feet, and penis

(2) Hair shaft is the visible part of the hair.

(3) Hair root is the part of the hair that is embedded in the dermis.

(4) Hair follicle is the cavity which contains the hair.

(5) Hair is kept soft and pliable by two or more sebaceous glands which secrete sebum.

(6) Also attached to the hair follicle are small bundles of involuntary muscle called "arrector pili muscles" that cause the hair to "stand on end."

(7) Hair color is due to different amounts of pigment within the hair shaft.

Note: Gray hair is due to loss of this pigment.

(8) Hair grows about one-half inch a month.

(9) A boil or furuncle is an infection of a hair follicle.

(10) Hair found around eyes and in the ears and nose performs a protective function in keeping out some dust and insects.

Note: Hair on the bulk of the skin has no apparent function.

b. **Nails**

(1) Consist of epidermal cells which have been converted to keratin

(2) Grow from epithelial cells lying under the white crescent (lunula) at the proximal end of the nail

(3) The subungual area is the area situated underneath a nail.

(4) Paronychia is a hangnail around the fingernail.

Information Sheet

c. **Skin glands**

  (1) Sebaceous glands

    (a) Secrete sebum to lubricate the hair
    (b) There are two or more sebaceous glands per hair follicle.
    (c) Keep hair supple and skin soft and pliant
    (d) Prevent excessive water evaporation and water absorption through the skin
    (e) Lesson the amount of heat lost from the skin

  (2) Sweat glands (sudoriferous glands)

    (a) Very small and numerous, especially on palms, soles, forehead, and axillae
    (b) Located in deep layers of dermis and exit through pores
    (c) A single square inch of skin on the palms of the hand contains 3,000 sweat glands.
    (d) Help maintain homeostasis of fluids and electrolytes and body temperature
    (e) Excrete nitrogenous wastes
    (f) Consist of tubes coiled into a tiny ball surrounded by capillaries

  (3) Ceruminous glands (modified sweat glands)

    (a) Located in external ear canals
    (b) Secrete cerumen

7. Functions of the skin

a. Protects by acting as a mechanical barrier against microorganisms, sunlight, and chemicals

b. Senses pain, heat, cold, touch, and pressure through nerve endings in the skin

c. Regulates body temperature by varying the amount of blood flowing through the skin and varying the amount of sweat excretion

Note: When stress occurs, the body releases moisture, thereby, releasing internal heat. When cold, the body retains sweat to keep in the heat.

d. Acts as excretory organ through sweat glands

e. Aids in maintaining fluid and electrolyte balance

Information Sheet

8. **Disorders and abnormalities of the skin and their definitions**

   a. **Acne** (pimples) — Infection and inflammation of sebaceous glands

   b. **Hives** (urticaria) — Sudden appearance of raised patches which are usually redder than the surrounding skin, often accompanied by severe itching, and usually caused by allergic reaction, infection, or stress

   c. **Decubitus ulcers** (bed sores) — Pressure sores on the body which are frequently found on the sacrum, elbows, and heels

   d. **Boils** (furuncles) — Inflammation and infection of the dermis and subcutaneous tissue caused by bacteria which enter through hair follicles

   e. **Vesicle** — A blister

   f. **Nodule** — A small node which is solid and irregular in form

   g. **Polyp** — A growth extending into the lumen of a mucous membrane or appearing on the skin

   h. **Pustule** — An elevation filled with pus

   i. **Cyst** — A sac which contains any fluid-like substance besides pus

   j. **Fissure** — A cleft or groove into the skin or other tissue

   k. **Ulcer** — A loss of substance on a cutaneous or mucous surface

Integumentary System
Unit 3

Student Supplement 1—Identify Parts of the Skin

Name ______________________________

Directions: Identify the parts of the skin in the following illustration. Place your answers in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

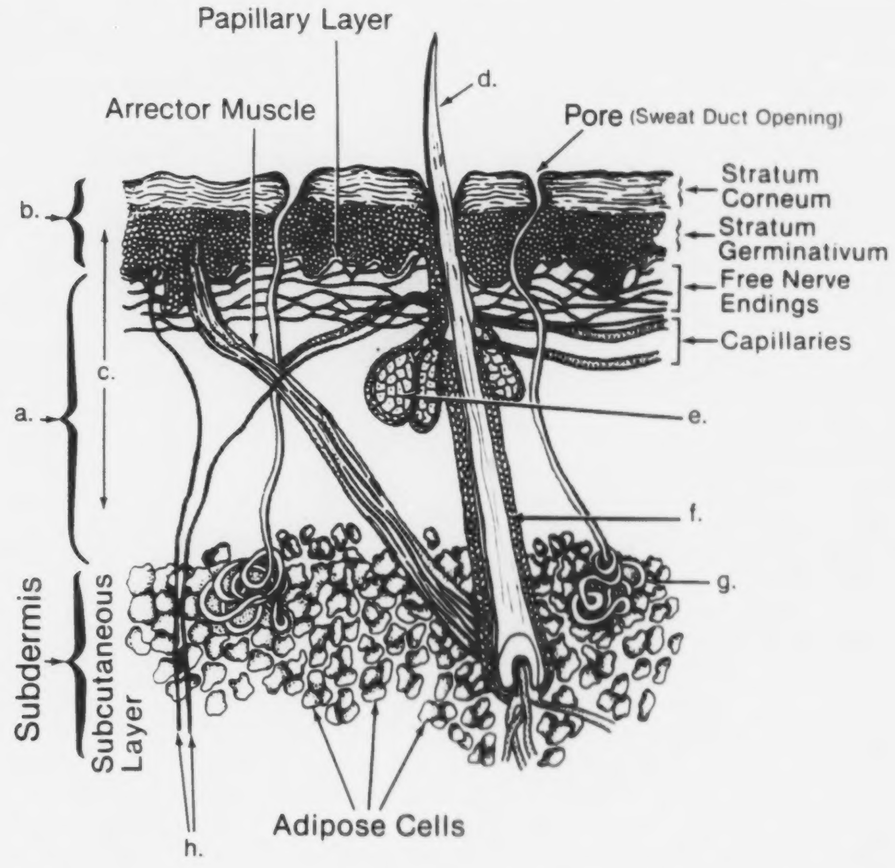
d. ______________________

e. ______________________

f. ______________________

g. ______________________

h. ______________________


Papillary Layer
Arrector Muscle
d.
Pore (Sweat Duct Opening)
Stratum Corneum
Stratum Germinativum
Free Nerve Endings
Capillaries
b.
c.
a.
e.
f.
g.
Subdermis
Subcutaneous Layer
Adipose Cells
h.

Skeletal System
Unit 4

Objective Sheet

Unit Objective

After completing this unit, the student should be able to identify the bones of the skeletal system, complete statements concerning bones and joint, and distinguish between the types of joints. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the skeletal system with the correct definitions.
2. List functions of the skeletal system.
3. Classify specific bones according to their type.
4. Select from a list the materials which make up the composition of bones.
5. Match types of bone markings with the correct descriptions.
6. Label a long bone with its structures.
7. Match components making up the structure of bones with the correct descriptions.
8. Complete statements concerning the characteristics of bone marrow.
9. Distinguish between the two parts of the human skeleton.
10. Identify the bones of the skull.
11. Complete statements concerning characteristics of the hyoid bone.
12. Identify regions and bones of the vertebral column.
13. Complete statements concerning characteristics of the ribs and sternum.
14. Identify the bones of the appendicular skeleton.
15. Select true statements concerning the functions of the articular system.

Objective Sheet

16. Match components of articular structure with the correct characteristics.
17. Complete a chart of articular classifications.
18. Match types of movable joints with the correct characteristics.
19. Match types of articular movements with the correct descriptions.
20. List the main cartilages and ligaments of the knee joint.
21. Select true statements concerning injury to the knee joint.

Skeletal System
Unit 4

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.
2. Review Teaching Suggestions section that follows. Plan for classroom activities.
3. Plan for students with special needs.
4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Structure of a Long Bone (Objective 6)
   TM 2—Axial Skeleton (Objective 9)
   TM 3—Appendicular Skeleton (Objective 9)
   TM 4—Bones of the Cranium (Objective 10)
   TM 5—Bones of the Face (Objective 10)
   TM 6—Bones of the Ear (Objective 10)
   TM 7—The Vertebral Column (Objective 12)
   TM 8—The Ribs and Sternum (Objective 13)
   TM 9—Examples of Articular Movements (Objective 19)

   Note: When the transparencies of 2 and 3 are placed on top of each other and aligned using the register marks, they produce a complete skeleton.
5. Obtain films, videotapes, and other resources to supplement instruction of this unit.
6. Develop teaching plan. Adjust for different learning styles.
7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.
9. Discuss unit and specific objectives.
10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.
11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Demonstrate the parts of the skeleton using articulated or disarticulated skeleton models or other wall-charts or diagrams.

2. Show available films on the skeletal system.

3. Discuss common problems of the skeletal system using X-rays.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.

2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.

3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.

4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Videotape—*I Am Joe's Spine*, part of the *I Am Joe's* Series available from several sources. Two companies offering this series include the following:

    a. Medcom/Trainex
    Box 3225
    Garden Grove, CA 92641
    800-877-1443

    b. Pyramid Film and Video
    P.O. Box 1048
    Santa Monica, CA 90406-1048
    800-421-2304

2. Anatomy charts, skeletons, and models of bones and the skull are available from many health and science education companies. Two of these companies are as follows:

    a. Health Edco
    P.O. Box 21207
    Waco, TX 76702-1207
    800-299-3366, x295 or 817-776-6461, x295

    b. Nebraska Scientific
    3823 Leavenworth Street
    Omaha, NB 68105
    800-228-7117

3. Audiotape—*Skeletal and Muscular Systems*, part of the *Medical Terminology Made Easy* Series of audiotapes available from:

    Health Sciences Consortium
    201 Silver Cedar Court
    Chapel Hill, NC 27514-1517
    919-942-8731

Muscular System
Unit 5

Answers to Written Test

1. a. 13 f. 17 k. 18
   b. 14 g. 2 l. 6
   c. 1 h. 10 m. 3
   d. 16 i. 5 n. 7
   e. 15 j. 4

2. a. SK f. SM
   b. SM g. C
   c. C h. SK
   d. SK i. SM or C
   e. SM j. SK

3. b, d, e, f

4. a. Epimysium
   b. Firmly
   c. Tendons
   d. Tendon
   e. Aponeurosis

5. a. Origin
   b. Body or belly
   c. Insertion

6. a. 5
   b. 3
   c. 6
   d. 1
   e. 4

7. a. 5 f. 11
   b. 10 g. 6
   c. 3 h. 4
   d. 9 i. 1
   e. 8 j. 7

8. a. Contraction
   b. Pulling on
   c. Proximal
   d. In groups
   e. Simple sugars

Answers to Written Test

9. a. 4
   b. 6
   c. 2
   d. 5
   e. 1

10. Any three of the following:

    a. Action
    b. Shape
    c. Origin and insertion
    d. Number of divisions composing muscle
    e. Direction of muscle fibers
    f. Location

11. a. 6
    b. 18
    c. 16
    d. 21
    e. 5
    f. 13
    g. 17
    h. 1
    i. 8
    j. 22
    k. 4
    l. 12
    m. 24
    n. 19
    o. 3
    p. 23
    q. 14
    r. 9
    s. 2
    t. 7
    u. 10
    v. 25
    w. 15
    x. 20
    y. 11

12. a. 17
    b. 18
    c. 5
    d. 15
    e. 27
    f. 25
    g. 6
    h. 3
    i. 28
    j. 4
    k. 16
    l. 19
    m. 23
    n. 12
    o. 13
    p. 1
    q. 7
    r. 14
    s. 9
    t. 10
    u. 22
    v. 21
    w. 2
    x. 11
    y. 8
    z. 26
    aa. 20

Muscular System
Unit 5

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______a. System of the human body involving muscles and their attachments that work with the skeletal system to produce movement

______b. Study of muscles

______c. Muscles in the group that oppose the action of the prime movers and that must be relaxed so that movement may take place

______d. Muscles that assist the prime movers by stabilizing the joint

______e. Muscles that are responsible for prime action

______f. Tough cord or band of dense, white, connective tissue that attaches a muscle to another part and that transmits the force which the muscle exerts

______g. Flat, thin, fibrous sheet of connective tissue that attaches muscle to bone or other tissues at their origin or insertion

______h. A band of strong, fibrous connective tissue connecting the articular ends of bones serving to bind them together and to facilitate or limit motion

______i. Outermost sheath of connective tissue which surrounds a skeletal muscle

1. Antagonists
2. Aponeurosis
3. Atrophy
4. Bursa
5. Epimysium (fascia)
6. Flaccid
7. Hypertrophy
8. Intramuscular
9. Involuntary
10. Ligament
11. Muscle fatigue
12. Muscle spasm
13. Muscular system
14. Myology
15. Prime movers
16. Synergists
17. Tendon
18. Voluntary

Written Test

______j. Sac or cavity lined with a synovial membrane and filled with synovial fluid that reduces friction between tendon and bone, tendon and ligament, or between other structures where friction is likely to occur

______k. Controlled by the will

______l. Lacking tone in muscle; flabby

______m. Wasting away (degeneration)

______n. Increase in size of an organ or structure

2. Distinguish between the three classifications of muscle tissue by placing the following letters next to the correct characteristics: "SK" for skeletal, "SM" for smooth, and "C" for cardiac.

______a. Is striated, made up of long slender striped cells

______b. Is non-striated, composed of spindle-shaped cells

______c. Is partially striated; special muscle tissue found only in the heart

______d. Is attached to the skeleton and moves its parts

______e. Is found in the viscera, especially the stomach, intestines, urinary ducts, and blood vessels

______f. Contracts slowly in response to stimulation of nerve impulses

______g. Contracts moderately fast in response to stimulation of nerve impulses

______h. Contracts quickly in response to stimulation of nerve impulses

______i. Is involuntary

______j. Is voluntary

3. Select major functions of the muscles by placing an "X" next to the correct functions.

______a. Assist in conducting nerve impulses to brain

______b. Assist in movement

______c. Produce hormones

Written Test

______d. Produce heat and energy resulting from a complicated chemical reaction

______e. Assist in protection of internal organs

______f. Assist in maintaining posture and balance

4. Complete the following statements concerning muscle attachments by circling the correct answers.

   a. Muscles are enclosed in the (epiphysis, epimysium) which is continuous with the fibrous structures that attach muscles to bones or other structures.

   b. The muscles must be (loosely, firmly) attached to the structures they pull on during contraction.

   c. Muscles may attach directly to the periosteum of bones or may be attached by (tendons, bursae) or aponeuroses.

   d. When the epimysium extends in the form of a strong, tough cord of connective tissue which is continuous with the periosteum of the bone, it is called a (tendon, ligament).

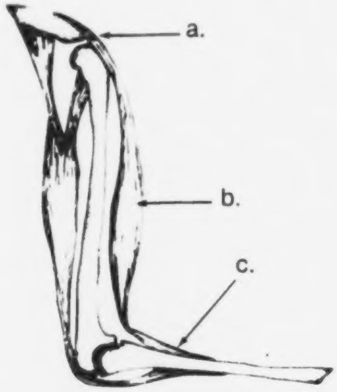
   e. When the epimysium extends as a broad, flat sheet of connective tissue and attaches to the adjacent structure, it is known as (an aponeurosis, a tendon).

5. Identify the parts of a muscle and place your answers in the blanks.

   a. ______________________________

   b. ______________________________

   c. ______________________________



Written Test

6. Match functional characteristics of muscle tissue on the right with the correct descriptions.

______a. The ability to respond to stimuli

______b. The ability to transmit impulses

______c. The ability to lengthen or stretch and hold

______d. The ability to resume former length when stretching force is removed

______e. The ability to contract or shorten and to thicken when a muscle shortens; it exerts pull

1. Elasticity
2. Tone or tonus
3. Conductivity
4. Contractility
5. Irritability
6. Extensibility

7. Match types of muscles on the right with the correct actions.

______a. Move away from a part

______b. Move toward a part or toward the midline

______c. Lift a part

______d. Lower a part

______e. Bend a joint

______f. Straighten a joint

______g. Revolve a part on its axis

______h. Ring-like muscles that close body openings

______i. Tense a part; make more rigid

______j. Turn the palm upward

1. Tensors
2. Pronators
3. Levators
4. Sphincters
5. Abductors
6. Rotators
7. Supinators
8. Flexors
9. Depressors
10. Adductors
11. Extensors

Written Test

8. Complete the following statements concerning the action of the skeletal muscles by circling the correct answers.

   a. The (elasticity, contraction) of skeletal muscles is caused by one of two ways — response to a natural stimulus or response to an artificial stimulus.

   b. Muscles move the body by (pulling on, stimulating bones).

   c. Muscles that move a part of the body usually lie (proximal, distal) to the part they move.

   d. Muscles act (in groups, alone).

   e. Muscle cells get their energy to contract from (simple sugars, fat).

9. Match muscle groups on the right with the correct functions.

   ______a. Used in defecation and urination and form the floor of the pelvic cavity

   ______b. Large broad muscles attached to the vertebrae which allow body to bend, turn, and stand erect

   ______c. Assist in respiration and movements of the neck, arms, and trunk

   ______d. Control talking, chewing, swallowing, facial expressions, and blinking

   ______e. Broad thin muscles which support internal organs, assist in respiration, and assist in eliminating waste from the large intestine and bladder

   1. Abdominal
   2. Chest
   3. Neck
   4. Perineal
   5. Head and face
   6. Back

10. List three criteria for remembering names of muscles.

   a. ____

   b. ____

   c. ____

Written Test

11. Identify the principal skeletal muscles on the next page by placing the numbers pointing to the muscles in the illustrations next to the following names of the muscles.

______a. Adductors

______b. Peroneus longus

______c. Sartorius

______d. Latissimus dorsi

______e. Biceps brachii

______f. External oblique

______g. Quadriceps femoris

______h. Orbicularis oris

______i. Orbicularis oculi

______j. Gluteus maximus

______k. Serratus anterior

______l. Rectus abdominis

______m. Triceps brachii

______n. Tibialis anterior

______o. Pectoralis major

______p. Gastrocnemius

______q. Internal oblique

______r. Masseter

______s. Deltoid

______t. Soleus

______u. Sternocleidomastoid

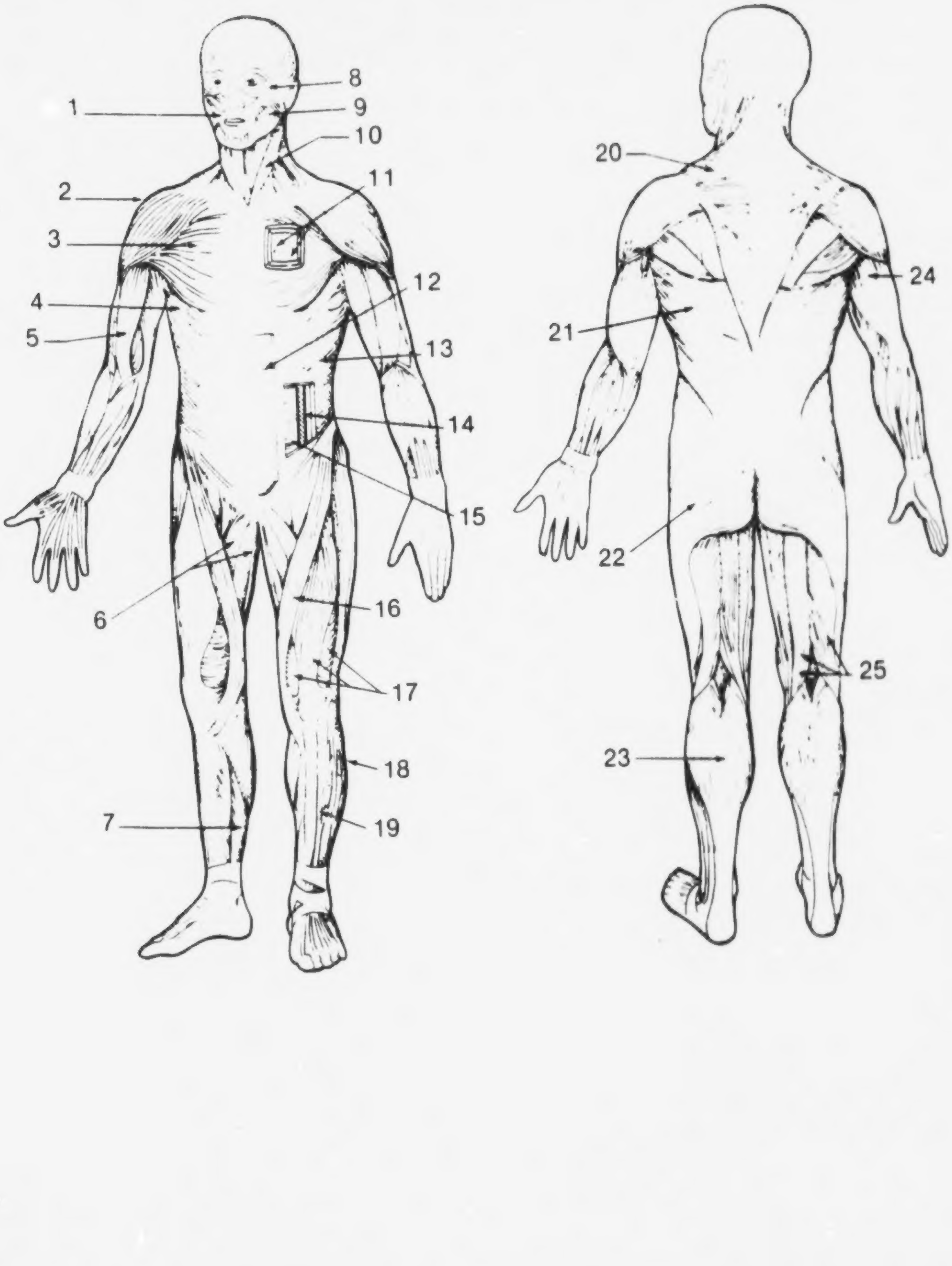
______v. Hamstrings

______w. Transversus abdominis

______x. Trapezius

______y. Intercostals

Written Test


1
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23
24
25

Written Test

12. Match the principal skeletal muscles on the right with the correct functions.

______a. Closes eyelids

______b. Draws lips together as in kissing

______c. "Trumpeter's muscle;" used in blowing, whistling, and smiling

______d. Closes jaw as in chewing

______e. Moves shoulders by raising and throwing them back; assists in moving head to one side or the other; hyperextends head when occiput acts as insertion; helps hold head erect

______f. Rotates head from side-to-side; flexes upper vertebral column and head as in bowing the head; "praying muscle;" helps hold head erect

______g. Moves the upper arm at the shoulder joint

______h. Flexes the upper arm when the hand is supinated

______i. Extends the upper arm

______j. Flexes the upper arm when the hand is pronated

______k. Flex and extend the forearms, wrists, and fingers

______l. Flexes and adducts upper arm anteriorly across the chest

______m. Moves the scapula forward, as in pushing something

______n. Assists in respirations by enlarging the thoracic cavity on inspiration

1. Abdominal muscles
2. Adductors
3. Biceps brachii
4. Brachialis
5. Buccinator
6. Deltoid
7. Diaphragm
8. Gastrocnemius
9. Gluteus maximus
10. Gluteus minimus
11. Hamstrings
12. Intercostals
13. Latissimus dorsi
14. Levator ani and coccygeus
15. Masseter
16. Muscles of the forearms
17. Orbicularis oculi
18. Orbicularis oris
19. Pectoralis major
20. Peroneus longus
21. Quadriceps femoris

Written Test

_______o. Brings down arms forcibly as in swimming

_______p. Assist indirectly in respiration as they relax when the diaphragm contracts, and vice versa; compress internal organs to aid in defecation, urination, and childbirth; assist in bending trunk in various directions

_______q. Main muscle used in breathing which contracts during inspiration and relaxes during expiration

_______r. Support pelvic organs and act on rectum to aid with defecation

_______s. Functions in maintaining an erect position, extends and rotates thigh, and is very important in walking and running

_______t. Abducts thigh, rotates thigh outward, stabilizes pelvis in femur, and extends the thigh

_______u. Adducts and flexes leg; called "tailor's muscle" because it is used in crossing legs

_______v. Extends knee as in kicking football; includes four parts

_______w. Include three in group; press thighs together, as in horseback riding

_______x. Include three in group; flex lower leg making angle at the knee joint smaller

_______y. Extends the foot; used to stand on tiptoes; is called the "dancer's muscle"

_______z. Flexes food and inverts ankle (used to walk on heels)

_______aa. Everts the ankle

22. Sartorius
23. Serratus anterior
24. Soleus
25. Sternocleidomastoid
26. Tibialis anterior
27. Trapezius
28. Triceps brachii

*Permission to duplicate this test is granted.

Muscular System
Unit 5

Unit Evaluation Form

Student Name ______________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

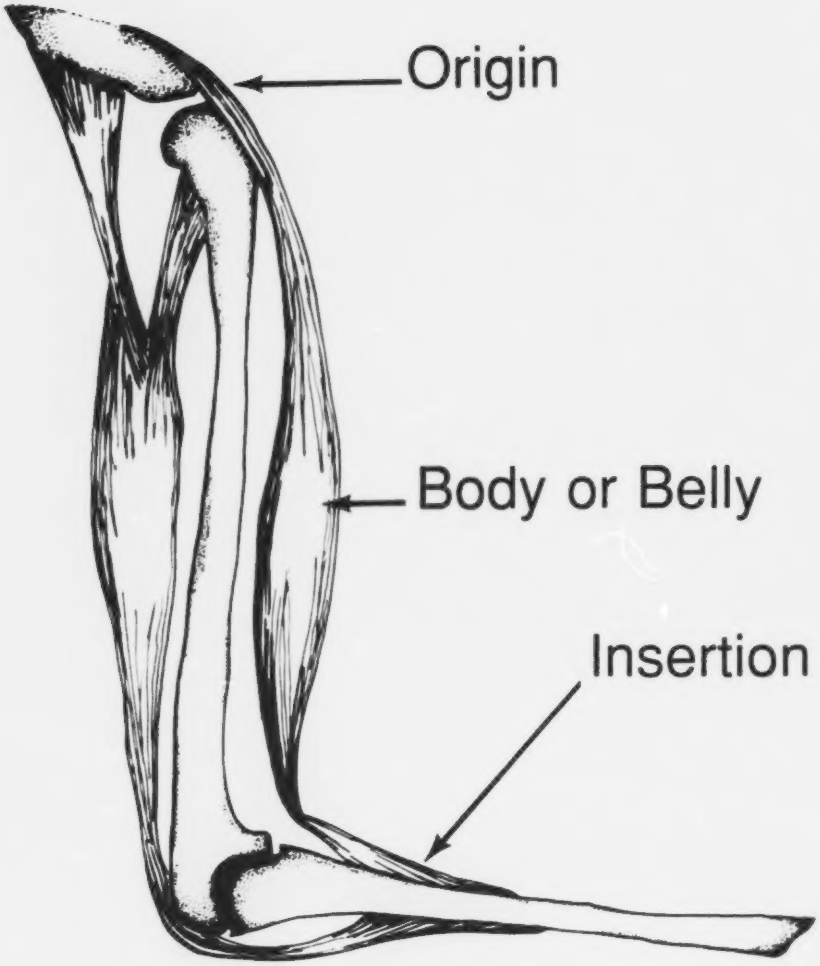
____

Teacher Signature ______________________ Date __________

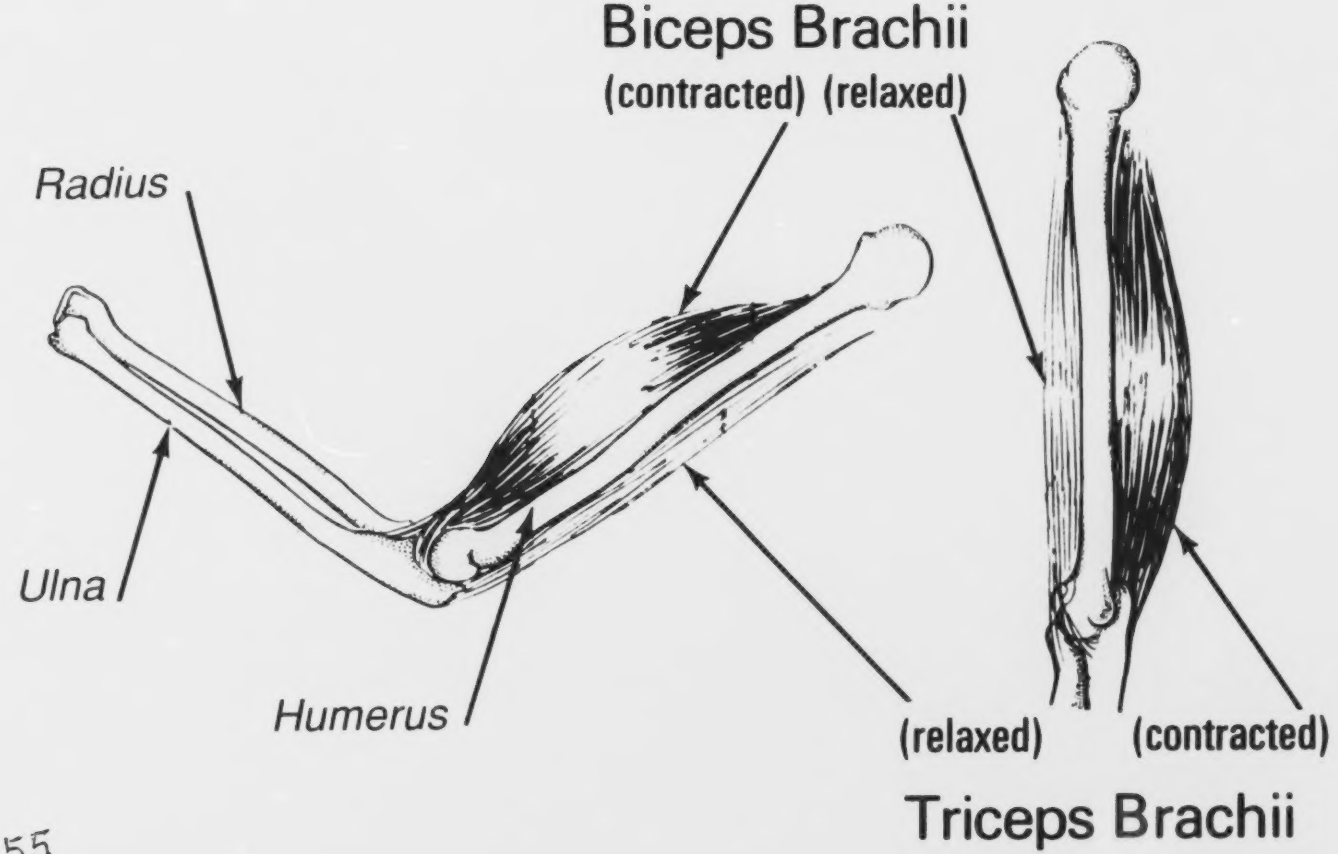
Student Signature ______________________ Date __________

*Permission to duplicate this form is granted.

Parts of a Muscle

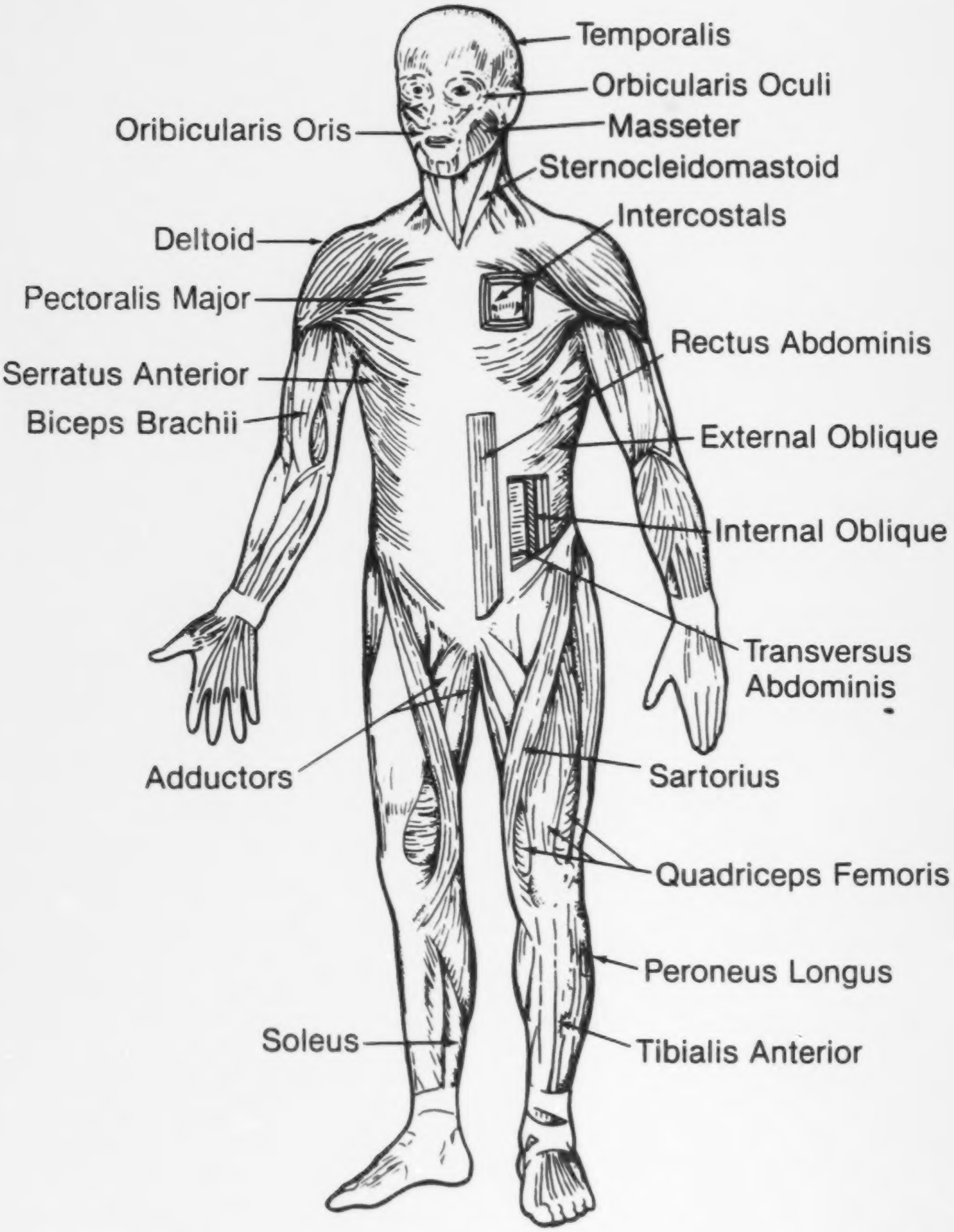

Origin
Body or Belly
Insertion

Coordinated Movement


Biceps Brachii
(contracted)
(relaxed)
Radius
Ulna
Humerus
(relaxed)
(contracted)
Triceps Brachii

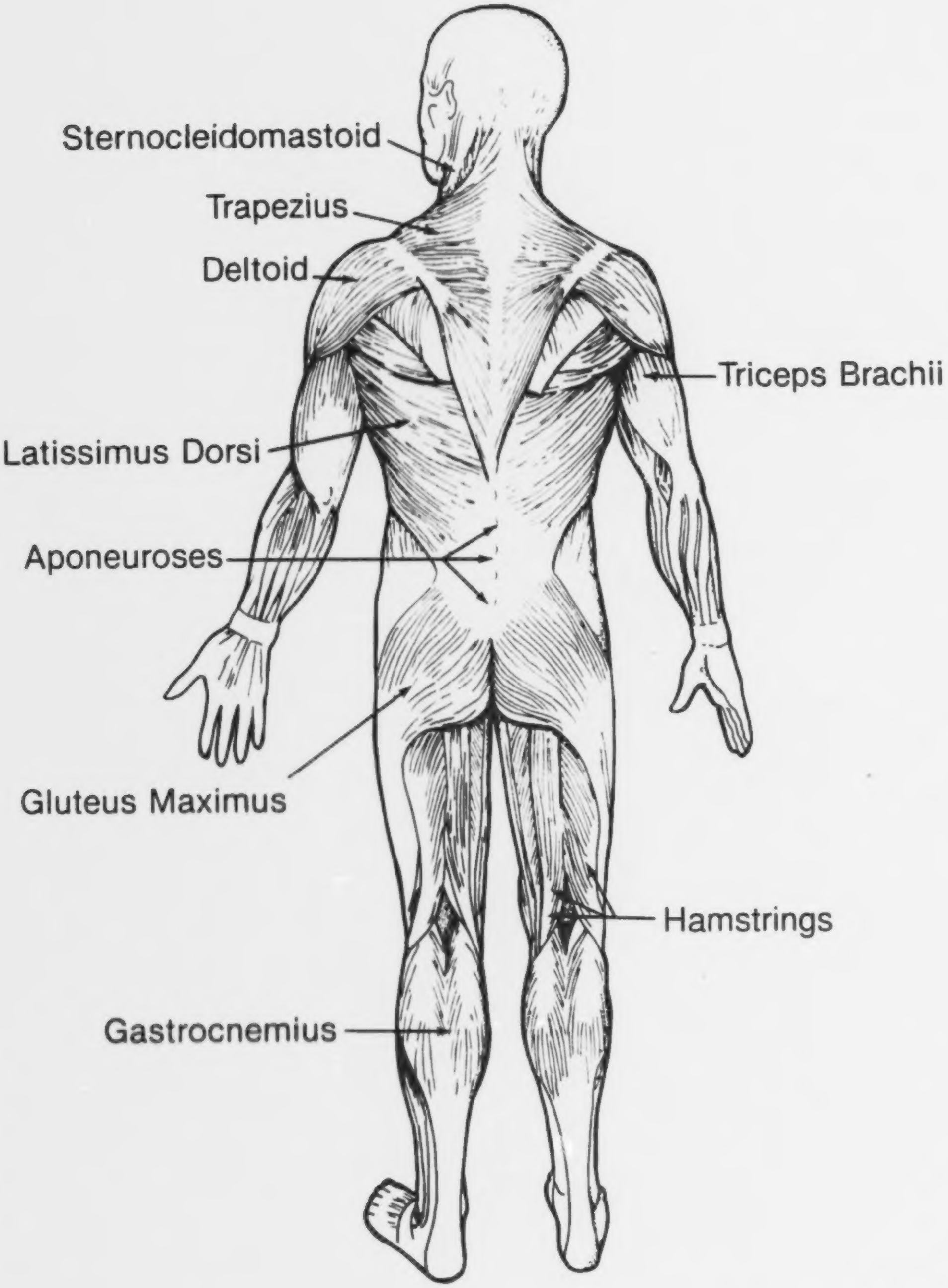
Muscles

Anterior View


Temporalis
Orbicularis Oculi
Oribicularis Oris
Masseter
Sternocleidomastoid
Intercostals
Deltoid
Pectoralis Major
Rectus Abdominis
Serratus Anterior
Biceps Brachii
External Oblique
Internal Oblique
Transversus Abdominis
Adductors
Sartorius
Quadriceps Femoris
Peroneus Longus
Soleus
Tibialis Anterior

Muscles

Posterior View



Sternocleidomastoid
Trapezius
Deltoid
Triceps Brachii
Latissimus Dorsi
Aponeuroses
Gluteus Maximus
Hamstrings
Gastrocnemius

Muscular System
Unit 5

Information Sheet

1. **Terms and definitions**

   a. **Antagonists** — Muscles in the group that oppose the action of the prime movers and that must be relaxed so that movement may take place

   b. **Aponeurosis** — Flat, thin, fibrous sheet of connective tissue that attaches muscle to bone or other tissues at their origin or insertion

   c. **Atrophy** — Wasting away (degeneration)

   d. **Bursa** — Sac or cavity lined with a synovial membrane and filled with synovial fluid that reduces friction between tendon and bone, tendon and ligament, or between other structures where friction is likely to occur

   e. **Epimysium (fascia)** — Outermost sheath of connective tissue which surrounds a skeletal muscle

   f. **Flaccid** — Lacking tone in muscle; flabby

   g. **Hypertrophy** — Increase in size of an organ or structure

   h. **Intramuscular** — Within a muscle

   i. **Involuntary** — Independent of the will

   j. **Ligament** — A band of strong, fibrous connective tissue connecting the articular ends of bones serving to bind them together and to facilitate or limit motion

   k. **Muscle fatigue** — Loss of power to contract after prolonged periods of muscle contraction

   l. **Muscle spasm** — An involuntary, abnormal muscular contraction

   m. **Muscular system** — System of the human body involving muscles and their attachments that work with the skeletal system to produce movement

   Note: The muscular system composes 35-50 percent of the total weight of the body.

   n. **Myology** — Study of muscles

Information Sheet

o. **Prime movers** — Muscles that are responsible for prime action

Note: Muscles usually do not act alone, but function as groups to move.

p. **Synergists** — Muscles that assist the prime movers by stabilizing the joint

q. **Tendon** — Tough cord or band of dense, white, connective tissue that attaches a muscle to another part and that transmits the force which the muscle exerts

r. **Voluntary** — Controlled by the will

2. **Classifications of muscle tissue**

a. **Skeletal**

(1) Is voluntary

(2) Is striated, made up of long slender striped cells

(3) Is attached to the skeleton and moves its parts

(4) Contracts quickly in response to stimulation of nerve impulses

(5) Acts in opposing groups, some relaxing while others are contracting

b. **Smooth**

(1) Is involuntary

(2) Is found in the viscera, especially the stomach, intestines, urinary ducts, and blood vessels

(3) Is non-striated, composed of spindle-shaped cells

(4) Contracts slowly in response to stimulation of nerve impulses

c. **Cardiac**

(1) Is involuntary

(2) Is partially striated

(3) Special muscle tissue found only in the heart

(4) Contracts moderately fast in response to stimulation of nerve impulses

Information Sheet

3. **Major functions of the muscles**

   a. Assist in movement

      (1) Large movements such as locomotion (moving from one place to another)

      (2) Small movements such as adjustment of pupil to light

      (3) Internal movements such as pushing blood through blood vessels and pulling air into the lungs and forcing it out

   b. Produce heat and energy resulting from a complicated chemical reaction

   c. Assist in maintaining posture and balance

   d. Assist in protection of internal organs

4. **Muscle attachments**

   a. Muscles are enclosed in the epimysium (fascia) which is continuous with the fibrous structures that attach muscles to bones or other structures.

   b. The muscles must be firmly attached to the structures they pull on during contraction.

   c. Muscles may attach directly to the periosteum of bones or may be attached by tendons or aponeuroses.

   d. When the epimysium extends in the form of a strong, tough cord of connective tissue which is continuous with the periosteum of the bone, it is called a tendon.

      Example: Achilles tendon in the heel

   e. When the epimysium extends as a broad, flat sheet of connective tissue and attaches to the adjacent structure, it is known as an aponeurosis.

5. **Parts of a muscle** (Figure 1)

   a. **Origin**

      (1) Less movable end of a muscle

      (2) Attached to the less movable end of a bone

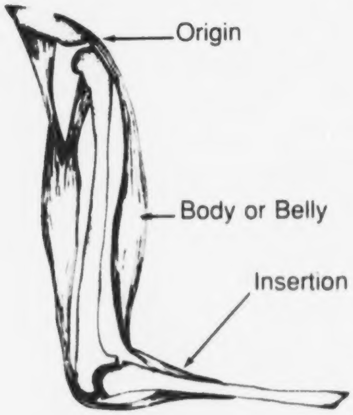
      (3) Usually is the end of the muscle closer to the trunk

   b. **Body or belly** — Main part of the muscle

   c. **Insertion** — Attachment on the more movable bone or the end farther away from the trunk

Information Sheet

Figure 1—Parts of a muscle



6. Functional characteristics of muscle tissue

a. **Irritability** — The ability to respond to stimuli

b. **Conductivity** — The ability to transmit impulses

c. **Extensibility** — The ability to lengthen or stretch and hold

d. **Elasticity** — The ability to resume former length when stretching force is removed

e. **Contractility** — The ability to contract or shorten and to thicken when a muscle shortens; it exerts pull

Note: Muscles work in pairs as they contract and relax.

f. **Tone or tonus** — Slight tension present in the muscle at all times, even when muscle is resting; a state of readiness to act more easily and quickly when needed

(1) Continued active use of a muscle causes it to increase in size (hypertrophy).

(2) Muscular atrophy may occur through lack of use or when nerve supply is damaged.

Note: Fatigue causes a muscle to lose some of its power to respond to stimulus.

Information Sheet

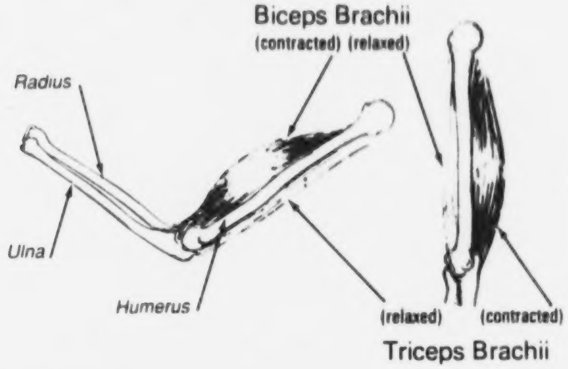
7. **Types of muscles and their actions**
   - a. Abductors — Move away from a part
   - b. Adductors — Move toward a part or toward the midline
   - c. Levators — Lift a part
   - d. Depressors — Lower a part
   - e. Flexors — Bend a joint
   - f. Extensors — Straighten a joint
   - g. Rotators — Revolve a part on its axis
   - h. Sphincters — Ring-like muscles that close body openings
   - i. Tensors — Tense a part; make a part more rigid
   - j. Supinators — Turn the palm upward
   - k. Pronators — Turn the palm downward

8. **Action of the skeletal muscles**
   - a. The contraction of skeletal muscles is caused by one of two ways:
     - (1) Response to a natural stimulus from a motor nerve
     - (2) Response to an artificial stimulus such as electrical current
   - b. Muscles move the body (locomotion) by pulling on bones.
   - c. Muscles that move a part of the body usually lie proximal to the part they move.

Information Sheet

d. Body movements are coordinated by the action of pairs of muscles. Any movement is produced by the coordinated actions of several muscles.

Figure 2—Coordinated movement



e. Muscles act in groups, not alone. Some of the muscles in the group contract while other relax.

f. Muscle cells get their energy to contract from simple sugars.

9. **Muscles grouped according to location and their functions**

a. **Head and face muscles** — Control talking, chewing, swallowing, facial expressions, and blinking

b. **Neck muscles** — Move head from side to side, forward and backward, and in rotation

c. **Back muscles** — Large broad muscles attached to the vertebrae which allow body to bend, turn, and stand erect

d. **Chest muscles** — Assist in respiration and movements of the neck, arms, and trunk

e. **Abdominal muscles** — Broad thin muscles which support internal organs, assist in respiration, and assist in eliminating waste from the large intestine and bladder

f. **Perineal muscles** — Used in defecation and urination and form the floor of the pelvic cavity

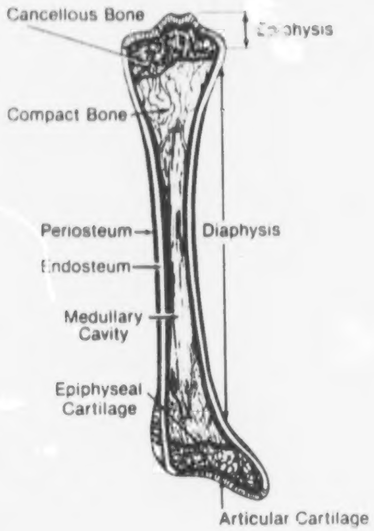
Skeletal System
Unit 4

Answers to Student Supplements

Student Supplement 1

1. Short bones
2. Long bone
3. Sesamoid
4. Flat bone
5. Long bone
6. Long bone
7. Irregular bone
8. Short bones
9. Irregular bones
10. Long bones

Student Supplement 2


Cancellous Bone
Epiphysis
Compact Bone
Periosteum
Diaphysis
Endosteum
Medullary Cavity
Epiphyseal Cartilage
Articular Cartilage

Student Supplement 3

a. 13
b. 5
c. 1
d. 11
e. 8
f. 10
g. 17
h. 12
i. 16
j. 3
k. 14
l. 6
m. 9
n. 4
o. 2
p. 15
q. 7

Answers to Student Supplements

Student Supplement 4

a. Cervical
b. Thoracic
c. Lumbar
d. Sacral
e. Coccygeal
f. C 1 or Atlas
g. Atlas or C 1
h. C 7
i. T 3
j. T 9
k. T 12
l. L 2
m. L 5
n. Sacrum
o. Coccyx

Student Supplement 5

a. Clavicle
b. Scapula
c. Humerus
d. Radius
e. Ulna
f. Carpals
g. Metacarpals
h. Phalanges
i. Os coxae or os innominatum
j. Femur
k. Patella
l. Tibia
m. Fibula
n. Tarsals
o. Metatarsals
p. Phalanges

Student Supplement 6

1. a
2. d
3. a
4. b
5. c
6. c
7. a
8. b
9. d
10. d
11. a
12. b
13. b
14. a
15. c
16. b
17. b
18. b
19. d
20. c
21. a
22. d
23. b
24. c

Student Supplement 7

1. a
2. d
3. d
4. b
5. d
6. c
7. a
8. a
9. c
10. b

Skeletal System
Unit 4

Answers to Written Test

1. a. 4
   b. 17
   c. 11
   d. 5
   e. 18
   f. 6
   g. 15
   h. 2
   i. 9
   j. 10
   k. 13
   l. 8
   m. 7

2. Any three of the following:
   a. Provides support and gives shape to the body
   b. Protects the delicate, vital organs
   c. Assists in body movement (with joints and muscles)
   d. Manufactures blood cells in the red bone marrow
   e. Stores calcium and phosphorus

3. a. Flat
   b. Long
   c. Irregular
   d. Flat
   e. Irregular
   f. Sesamoid
   g. Short
   h. Long

4. a, b, e

5. a. 5
   b. 11
   c. 9
   d. 2
   e. 4
   f. 8
   g. 7
   h. 6
   i. 10
   j. 3

6. a. Cancellous bone
   b. Compact bone
   c. Periosteum
   d. Endosteum
   e. Medullary cavity
   f. Epiphysis
   g. Diaphysis

7. a. 6
   b. 5
   c. 4
   d. 11
   e. 2
   f. 8
   g. 1
   h. 10
   i. 9

Answers to Written Test

8. a. Soft, spongelike
   - b. In cavities
   - c. Platelets
   - d. Yellow
   - e. Blood cells
   - f. Red
   - g. Vertebral bodies

9. c, e, f

10. a. Parietal
    - b. Temporal
    - c. Occipital
    - d. Frontal
    - e. Sphenoid
    - f. Nasal
    - g. Lacrimal
    - h. Zygomatic
    - i. Maxillary (Maxilla)
    - j. Mandible

11. a. U-shaped
    - b. Articulate with another bone
    - c. Temporal
    - d. Tongue

12. a. Cervical
    - b. Thoracic
    - c. Lumbar
    - d. Sacral
    - e. Coccygeal
    - f. Atlas or C1
    - g. Axis or C2
    - h. C7
    - i. T5
    - j. L3
    - k. Sacrum
    - l. Coccyx

13. a. Thoracic
    - b. 12
    - c. Thoracic
    - d. 7
    - e. Cartilages
    - f. 5
    - g. Do not
    - h. 3, cartilage
    - i. 2
    - j. Breast bone
    - k. Xiphoid process

14. a. Clavicle
    - b. Scapula
    - c. Humerus
    - d. Radius
    - e. Ulna
    - f. Os coxae or os innominatum
    - g. Carpals
    - h. Metacarpals
    - i. Phalanges
    - j. Femur
    - k. Patella
    - l. Tibia
    - m. Fibula
    - n. Tarsals
    - o. Metatarsals
    - p. Phalanges

Answers to Written Test

15. a, b, c

16. a. 2
    b. 3
    c. 3
    d. 1
    e. 2
    f. 3

17. a. Fibrous joints
    b. Immovable
    c. Sutures of the skull
    d. Slightly
    e. Cartilage
    f. Diarthroses
    g. Wrist joint
    h. Elbow joint
    Note: There are many movable joints that the student may answer for g and h.

18. a. 2
    b. 6
    c. 3
    d. 1
    e. 5

19. a. 7
    b. 3
    c. 10
    d. 5
    e. 1
    f. 9
    g. 4
    h. 2

20. a. (1) Medial meniscus
    (2) Lateral meniscus
    b. (1) Anterior and posterior cruciate ligaments
    (2) Fibular and tibial collateral ligaments

21. b

Skeletal System
Unit 4

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______a. The connection of bones; a joint

______b. Lines of union of cranial bones by a thin fibrous membrane which eventually disappears

______c. An extension at the proximal end of the ulna

______d. Pertaining to a line running through the center of a body; also pertaining to head and trunk

______e. Thin, elongated process extending caudally from body of sternum

______f. Padlike sac or cavity found in connective tissue usually near a joint which is lined with a synovial membrane and filled with synovial fluid which helps to reduce friction between moving parts

______g. A projection or outgrowth of bone or tissue

______h. Science dealing with the study of joints

______i. Point of junction between two bones

______j. A band of fibrous connective tissue connecting bones, cartilages, and other structures and serving for support or for attachment of fascia or muscles

______k. Any small bone (especially one of the small bones in the ear)

1. Appendicular
2. Arthrology
3. Articular system
4. Articulation
5. Axial
6. Bursa
7. Cartilage
8. Fontanels
9. Joint
10. Ligament
11. Olecranon process
12. Os
13. Ossicle
14. Osteology
15. Process
16. Skeletal system
17. Sutures
18. Xiphoid process

Written Test

______l. Unossified spaces or soft spots lying between the cranial bones of the skull of a fetus or infant

______m. A type of dense connective tissue consisting of cells embedded in a matrix which is firm, compact, and capable of withstanding pressure and tension

2. List three functions of the skeletal system.

a. ______________________________

b. ______________________________

c. ______________________________

3. Classify the following bones according to their type — Long, short, flat, irregular, or sesamoid.

Example: Ulna — Long bone

a. Ilium — ______________________________

b. Tibia — ______________________________

c. Sphenoid — ______________________________

d. Ribs — ______________________________

e. Coccyx — ______________________________

f. Patella — ______________________________

g. Tarsals — ______________________________

h. Radius — ______________________________

4. Select materials which make up the composition of bones by placing an "X" next to the correct components.

______a. Inorganic salts

______b. Organic materials such as nerves and blood vessels

______c. Stored carbohydrate

______d. Glycogen

______e. Water

Written Test

5. Match types of bone markings on the right with the correct descriptions.

_____a. A hollow or depression

_____b. A cavity or spongelike space in a bone (frontal) which is mucous-lined and filled with air spaces

_____c. A hole

_____d. A tube-shaped opening

_____e. A very large process

_____f. A sharp projection

_____g. A large, rounded projection

_____h. A small, rounded projection

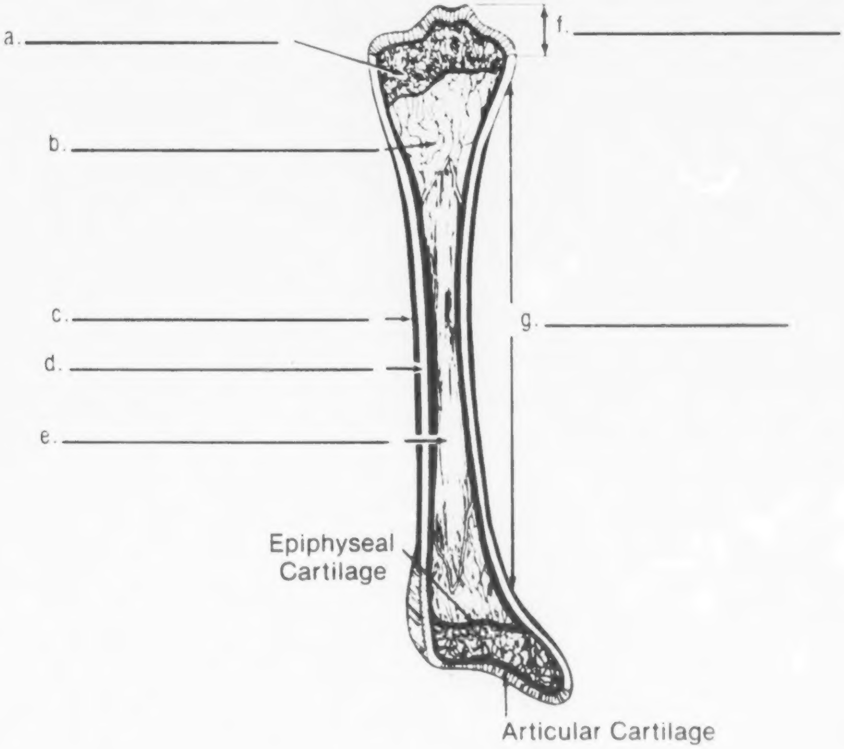
_____i. A rounded projection that enters into formation of a joint

_____j. A rounded projection beyond a narrow neckline portion

1. Crest
2. Meatus
3. Head
4. Trochanter
5. Fossa
6. Tubercle
7. Tuberosity
8. Spinous process or spine
9. Foramen
10. Condyle
11. Sinus

Written Test

6. Label the following bone with its structures.



7. Match components making up the structure of bones on the right with the correct descriptions.

_____ a. The main shaftlike portion of a bone

_____ b. Bulbous-shaped extremities of long bones that provide generous space for muscle attachments near the joints; bone growth occurs here

_____ c. Wide part at the extremity of the shaft of a long bone that supports the epiphysis

_____ d. Thin cartilage covering the articular surface of each epiphysis that cushions jars and blows

1. Endosteum
2. Periosteum
3. Foramen
4. Metaphysis
5. Epiphysis
6. Diaphysis
7. Bone marrow

Written Test

______e. The fibromuscular membrane that covers the bone except at joint surfaces where the articular cartilage forms the covering; also nourishes the bone

______f. A cavity running the length of the diaphysis which contains bone marrow

______g. A condensed layer of bone marrow which lines the medullary cavity

______h. The hard bone that is found outside the medullary cavity in the shaft of long bones

______i. The spongy tissue found in the epiphyseal portion of long bones

8. Medullary cavity
9. Cancellous bone
10. Compact bone
11. Articular cartilage

8. Complete the following statements concerning the characteristics of bone marrow by circling the correct answers.

   a. Is a (soft spongelike, hard compact) material

   b. Is found (as a covering, in cavities) of bones

   c. Manufactures red blood cells, white blood cells, and (platelets, glucose)

   d. Consists of two types: Red bone marrow and (white, yellow) bone marrow

   e. Red bone marrow produces (glucose, blood cells, growth).

   f. During infancy and childhood, all bone marrow is (yellow, white, red).

   g. In adulthood, red marrow is contained in only a few locations such as diploe, ribs, sternum, and (tarsals, vertebral bodies).

Written Test

9. Distinguish between the two parts of the human skeleton by placing an "X" next to the characteristics of the axial skeleton.

______a. Are attached to the axis as appendages

______b. Composed of 126 bones

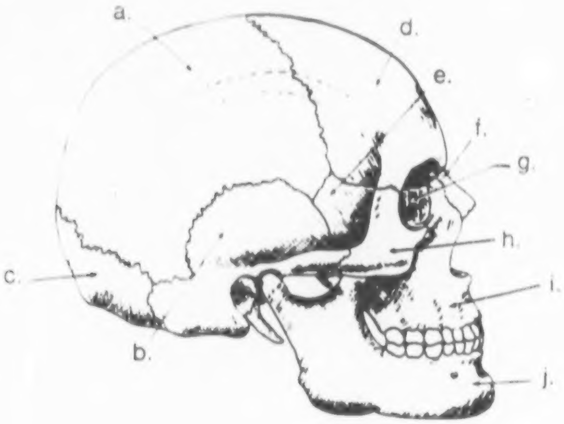
______c. Composed of 80 bones

______d. Consist of the shoulder and pelvic girdles, and the upper and lower extremities

______e. Forms the upright part or axis of the body

______f. Consists of hyoid, the skull, vertebral column, ribs, and sternum

10. Identify the following bones of the skull and place your answers in the blanks provided



a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

f. ______________________

g. ______________________

h. ______________________

i. ______________________

j. ______________________

Written Test

11. Complete the following statements concerning characteristics of the hyoid bone by circling the correct answers.

    a. Is the (inverted. u-shaped) bone in neck between mandible and upper part of larynx

    b. Only bone in the body which does not (articulate with another bone. contain bone marrow)

    c. Suspended by ligaments on processes from (occipital. temporal) bone in cranium

    d. (Soft palate. Tongue) is connected to the hyoid.

12. Identify the following regions and bones of the vertebral column and place your answers in the blanks provided.

Note: Bones must be identified with both the letter and number or name.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

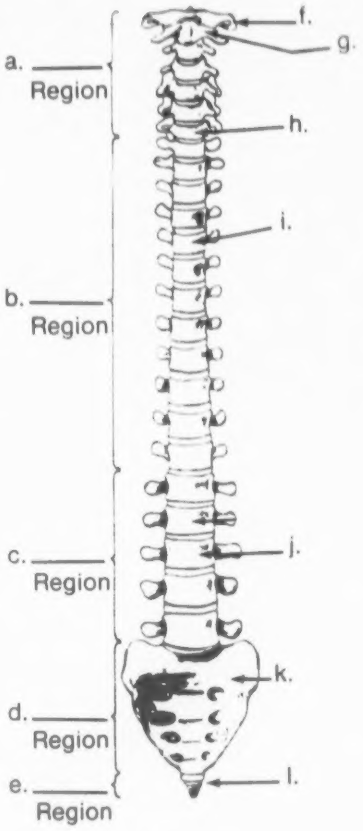
h. ______________________________

i. ______________________________

j. ______________________________

k. ______________________________

l. ______________________________



Written Test

13. Complete the following statements concerning characteristics of ribs and the sternum by circling the correct answers.

    a. The ribs and sternum form the (cervical, thoracic) cavity.

    b. There are (7, 8, 12) pairs of ribs.

    c. All ribs attach to the (cervical, thoracic) region of the vertebral column.

    d. The upper (5, 7) pairs of ribs are called "true ribs."

    e. "True ribs" are attached to the sternum by costal (cartilages, muscles).

    f. The lower (2, 3, 5) pairs of ribs are called "false ribs."

    g. "False ribs" (do, do not) attach to the sternum directly.

    h. The upper (3, 5) pairs of false ribs attach to the seventh costal (cartilage, muscle).

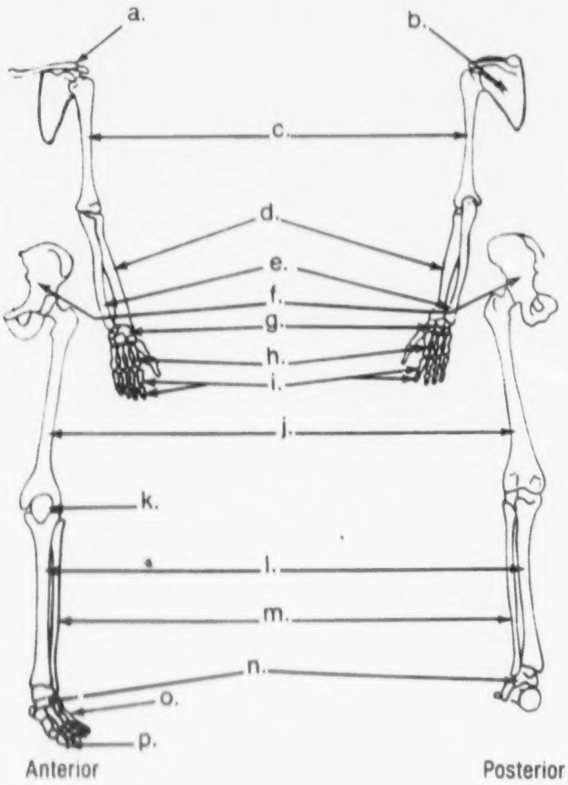
    i. The lower (2, 3, 5) pairs of false ribs do not attach at all, and are called "floating ribs."

    j. The sternum is one bone that is also called the (shoulder blade, breast bone).

    k. The lowest division of the sternum is called the (manubrium, gladiolus, xiphoid process).

Written Test

14. Identify the following bones of the appendicular skeleton and place your answers in the blanks provided.


a.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.
l.
m.
n.
o.
p.
Anterior
Posterior

a.	______________________	i.	______________________
b.	______________________	j.	______________________
c.	______________________	k.	______________________
d.	______________________	l.	______________________
e.	______________________	m.	______________________
f.	______________________	n.	______________________
g.	______________________	o.	______________________
h.	______________________	p.	______________________

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Written Test

15. Select true statements concerning the functions of the articular system by placing an "X" next to the true statements.

______a. Joints allow for changes of position and body motion.

______b. Joints help to bear weight of the body.

______c. The joint capsule, ligaments, tendons, muscles, and articular discs provide stability.

______d. Blood lubricates the joints and nourishes the cartilages.

16. Match components of articular structure on the right with the correct characteristics.

______a. Are found where bones meet adjacent bones

______b. Resembles the white of a raw egg

______c. Provides the major source of nutrition for the articular cartilage

______d. Are connective tissue bands which hold bones together

______e. Are smooth layers of cartilage that cover the ends of opposing bones

______f. Is secreted by the synovial membrane

1. Ligaments
2. Articular cartilages
3. Synovial fluid

Written Test

17. Complete the following chart of articular classifications.

Name	Degree Of Movement	Characteristics	Examples
Synarthroses (ⓐ ______ ______)	ⓑ ______	Do not have a joint cavity Fibrous cartilage or bone tissue grows between the articulating surfaces	ⓒ ______ Facial bones except mandible Distal tibiofibular joint
Amphiarthroses (Cartilaginous joints)	ⓓ ______ movable	Held together by ⓔ ______ Two types: (1) Symphyses — "A growing together" of bones at body midline (2) Synchondroses — Held together with cartilage	(1) Symphysis pubis (between pubic bones) and joints between the vertebrae (2) Joints between ribs and sternum
ⓕ ______ (Synovial joints)	Freely movable	Have a joint cavity enclosed by articular capsule Have ligaments that cover and connect the ends of opposing bones Have synovial fluid Divided into six classes according to shape of articulating ends of involved bones	Hip and femur joint Knee joint ⓖ ______ ⓗ ______ Shoulder joint

Written Test

18. Match types of movable joints on the right with the correct characteristics.

______a. A convex surface fits into a concavity; has an angular movement in one direction, like a door; motion is limited to flexion and extension in a single plane; examples include knee joint, elbow joint, and finger joint

______b. Articular surfaces are flat, or slightly concave, and the other slightly convex; permits a nonaxial gliding movement only; examples include joints between carpals and between tarsals

______c. A pivot-like process rotates within a bony fossa around a longitudinal axis; motion is limited to uniaxial rotation; example includes articulation between axis and atlas for rotation of head

______d. The round-shaped head fits into a concave socket; provides the widest range of motion, with movement in all planes in addition to rotation; examples include hip and femur (acetabulum) and humerus and glenoid cavity of scapula (shoulder joint)

______e. Articular surface of each bone is concave in one direction and convex in another; similar in function to condyloid joints with movement possible in two directions; example is the joint between the carpals and thumb metacarpals

1. Ball and socket
2. Hinge
3. Pivot
4. Condyloid
5. Saddle
6. Gliding

Written Test

19. Match types of articular movements on the right with the correct descriptions.

_______a. Bending or decreasing the angle between two bones

_______b. Straightening or increasing the angle between two bones

_______c. Moving the bone away from the midline

_______d. Moving the bone toward the midline

_______e. Moving the bone around a central axis; the plane of motion is perpendicular to the axis

_______f. Moving the bone so that the end of it describes a circle and the sides of it describe a cone

_______g. Moving the bones of the forearm so that the radius and ulna are parallel; the palm is moved from a posterior to an anterior position

_______h. Moving the sole of the foot outward at the ankle joint

1. Rotation
2. Eversion
3. Extension
4. Supination
5. Adduction
6. Pronation
7. Flexion
8. Inversion
9. Circumduction
10. Abduction

20. List the main cartilages and ligaments of the knee joint.

a. Two semilunar cartilages

(1) ____

(2) ____

b. Two main sets of ligaments

(1) ____

(2) ____

Written Test

21. Select true statements concerning injury to the knee joint by placing an "X" next to the true statements.

______a. Injury is caused by a superficial derangement.

______b. The most common derangement of the knee is a tear of the semilunar cartilage, which usually results from a twisting injury.

______c. The lateral meniscus is more frequently damaged than the medial one.

***Permission to duplicate this test is granted.**

Skeletal System
Unit 4

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

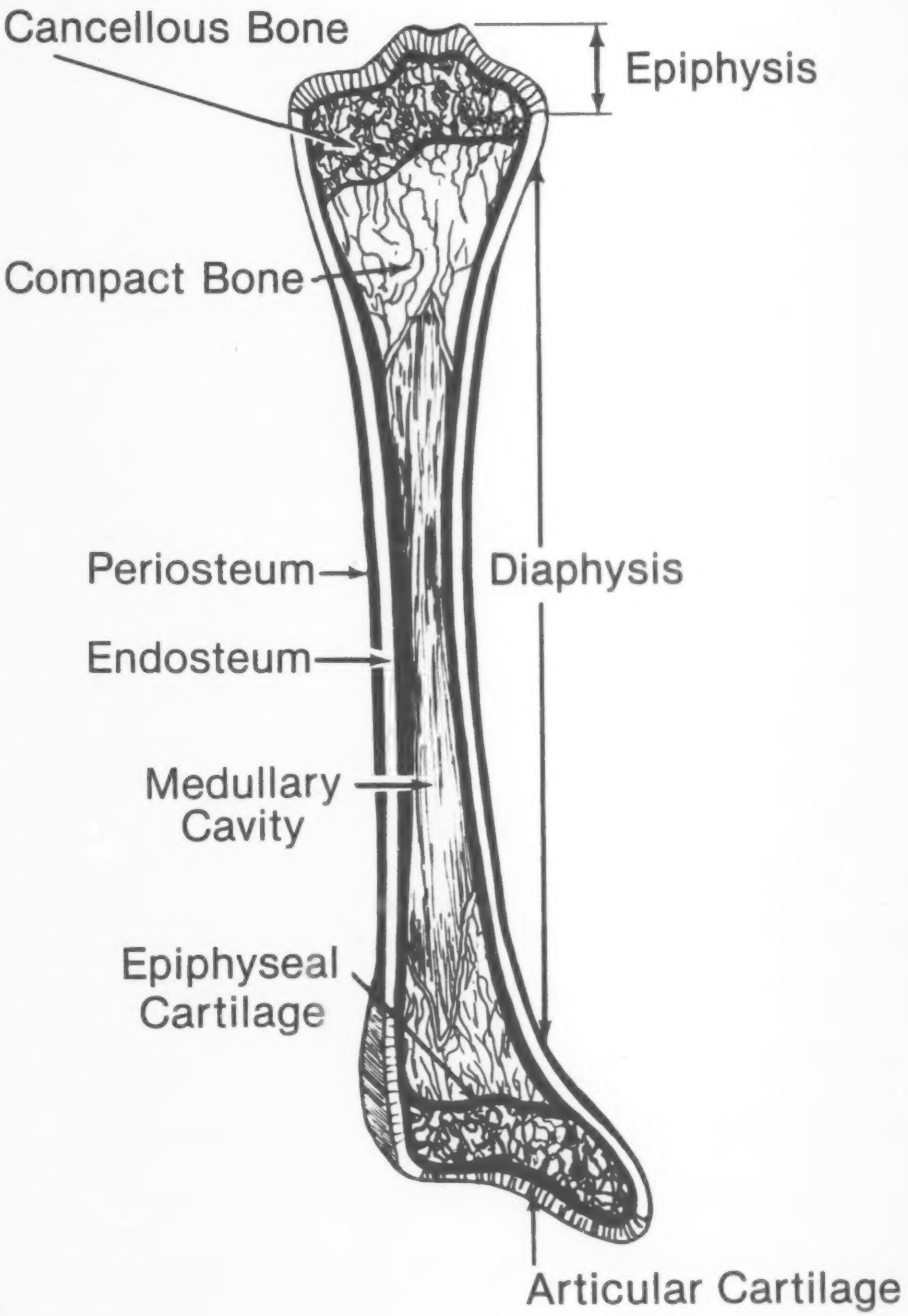
____

Teacher Signature ______________________________ Date __________

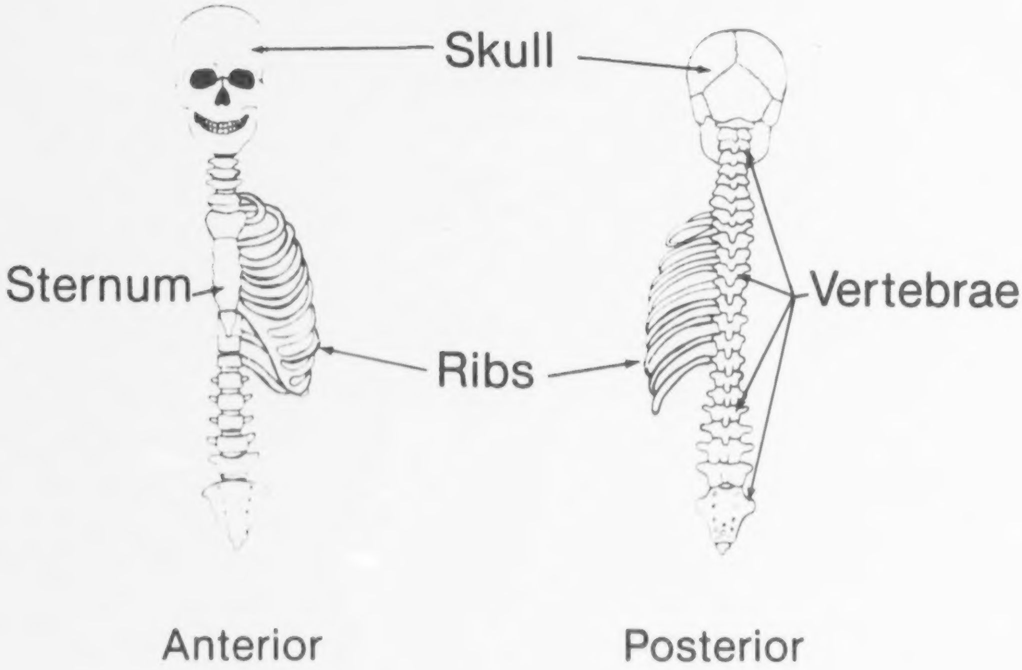
Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.

Structures of a Long Bone

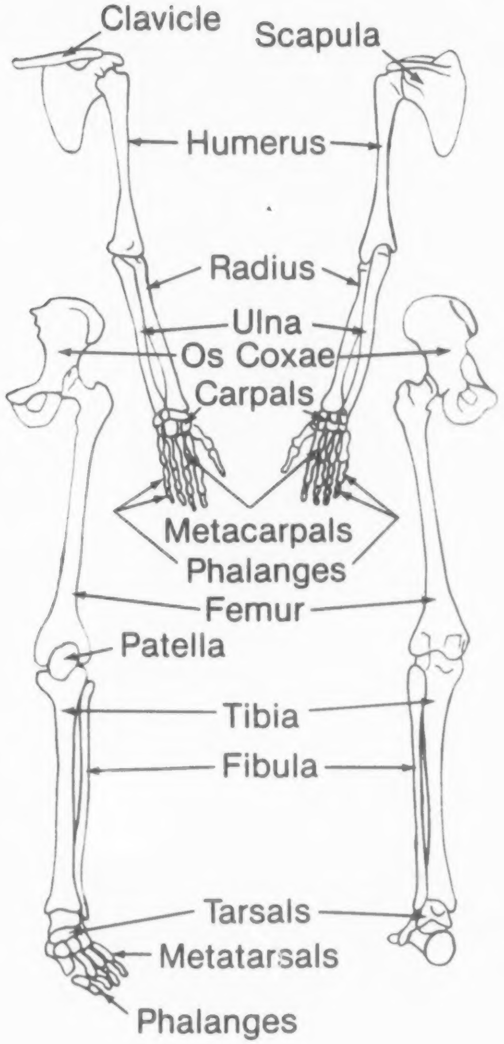

Cancellous Bone
Epiphysis
Compact Bone
Periosteum
Diaphysis
Endosteum
Medullary Cavity
Epiphyseal Cartilage
Articular Cartilage

Axial Skeleton


Skull
Sternum
Vertebrae
Ribs
Anterior
Posterior

*

Appendicular Skeleton


Clavicle
Scapula
Humerus
Radius
Ulna
Os Coxae
Carpals
Metacarpals
Phalanges
Femur
Patella
Tibia
Fibula
Tarsals
Metatarsals
Phalanges

Anterior Posterior

*

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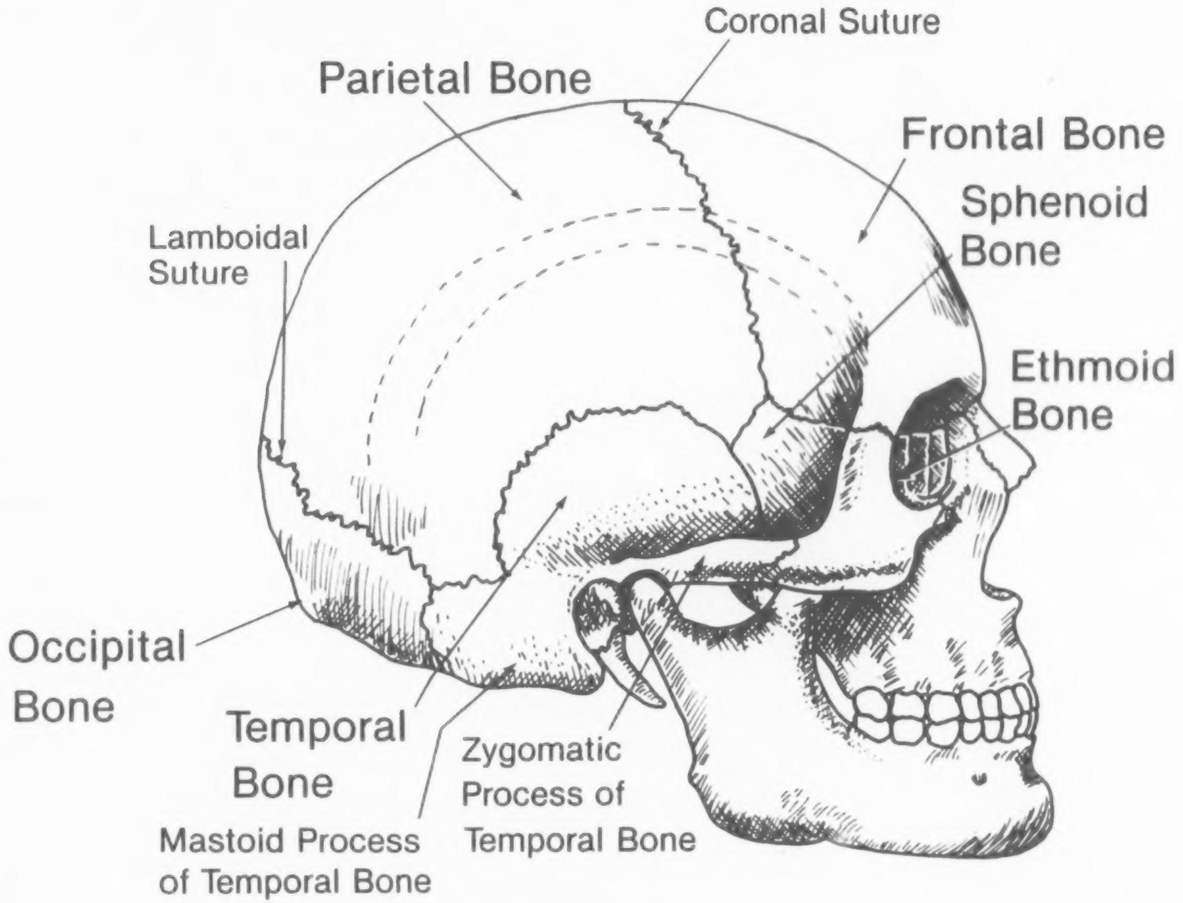
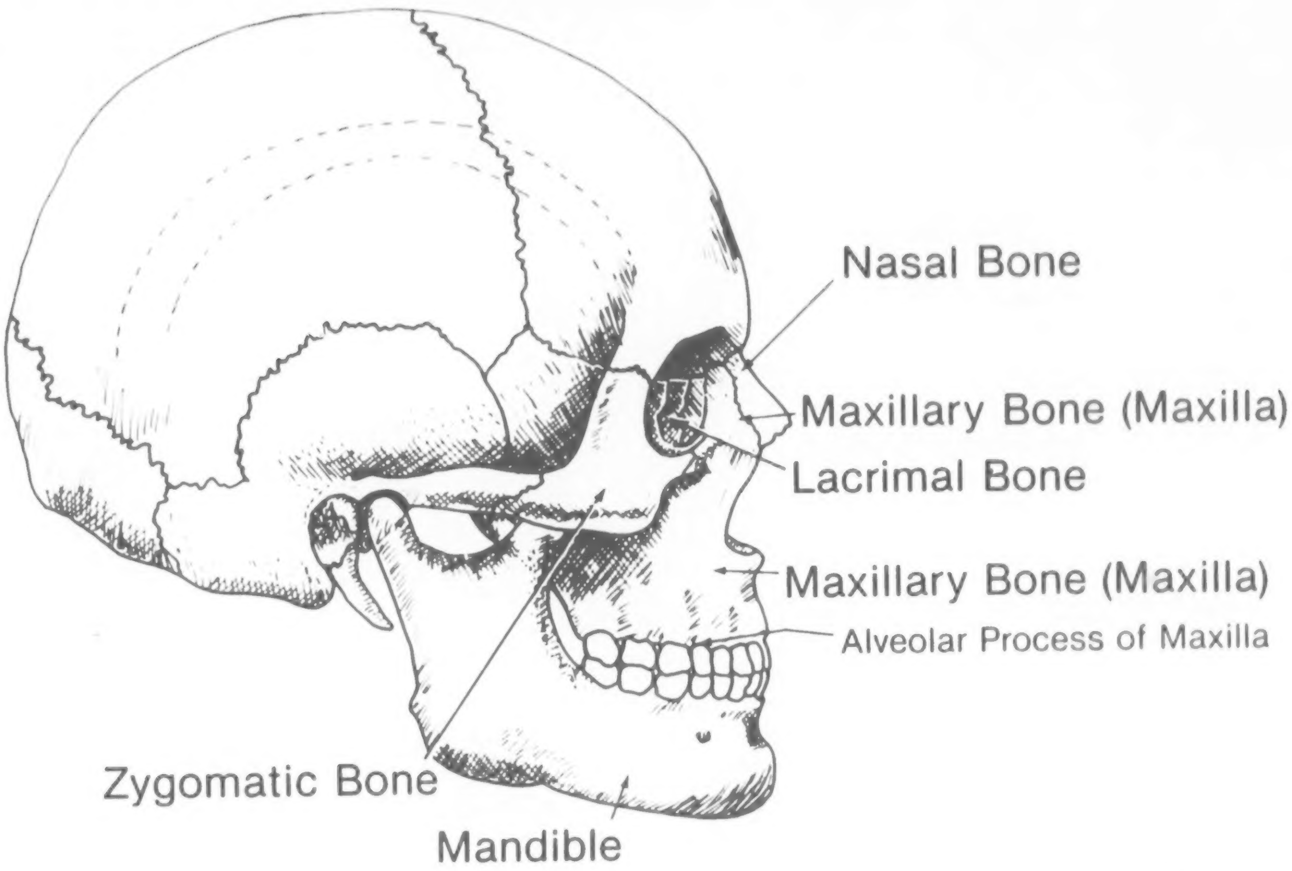
Bones of the Cranium


Coronal Suture
Parietal Bone
Frontal Bone
Sphenoid Bone
Lamboidal Suture
Ethmoid Bone
Occipital Bone
Temporal Bone
Zygomatic Process of Temporal Bone
Mastoid Process of Temporal Bone

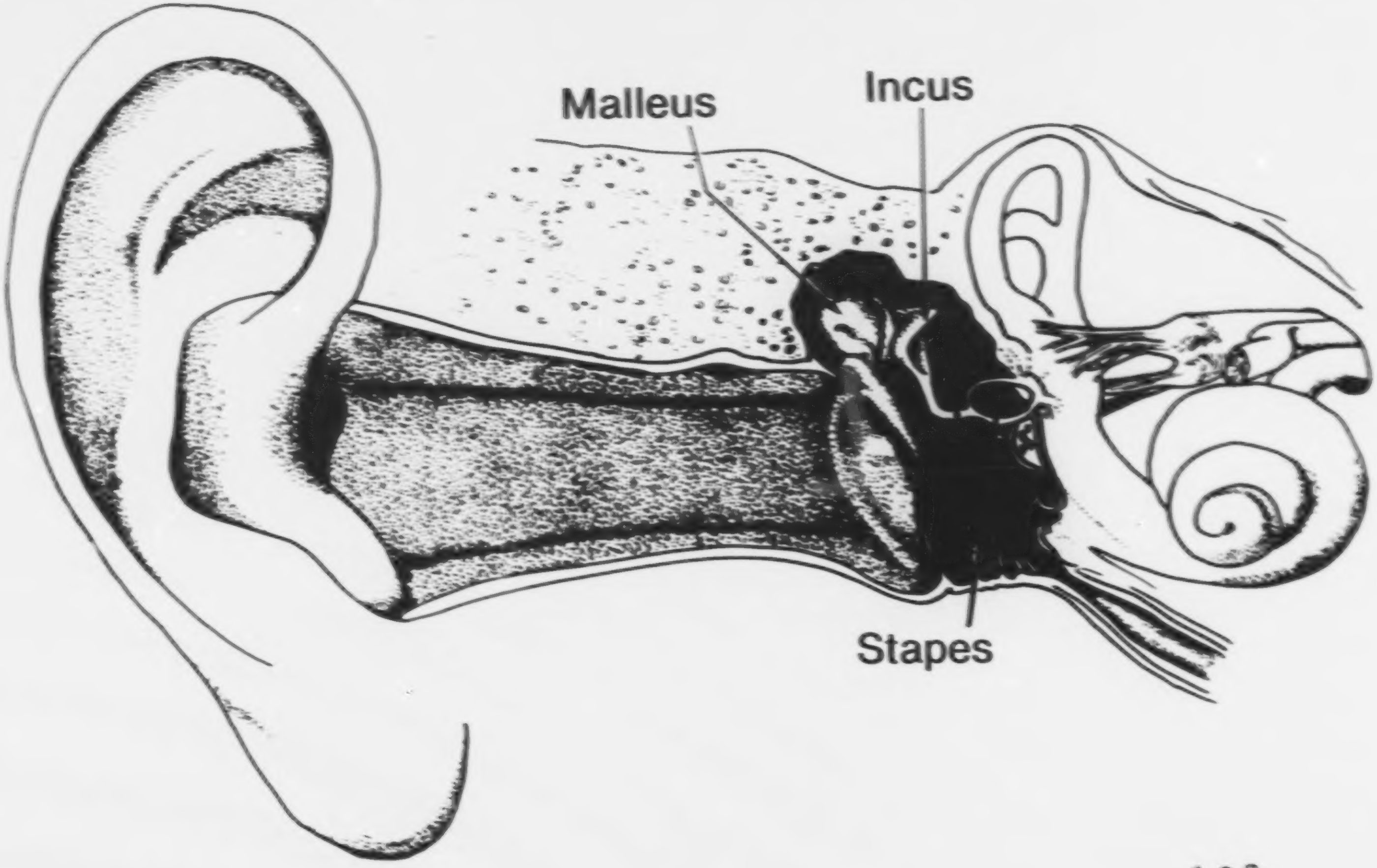
Bones of the Face


Nasal Bone
Maxillary Bone (Maxilla)
Lacrimal Bone
Maxillary Bone (Maxilla)
Alveolar Process of Maxilla
Zygomatic Bone
Mandible

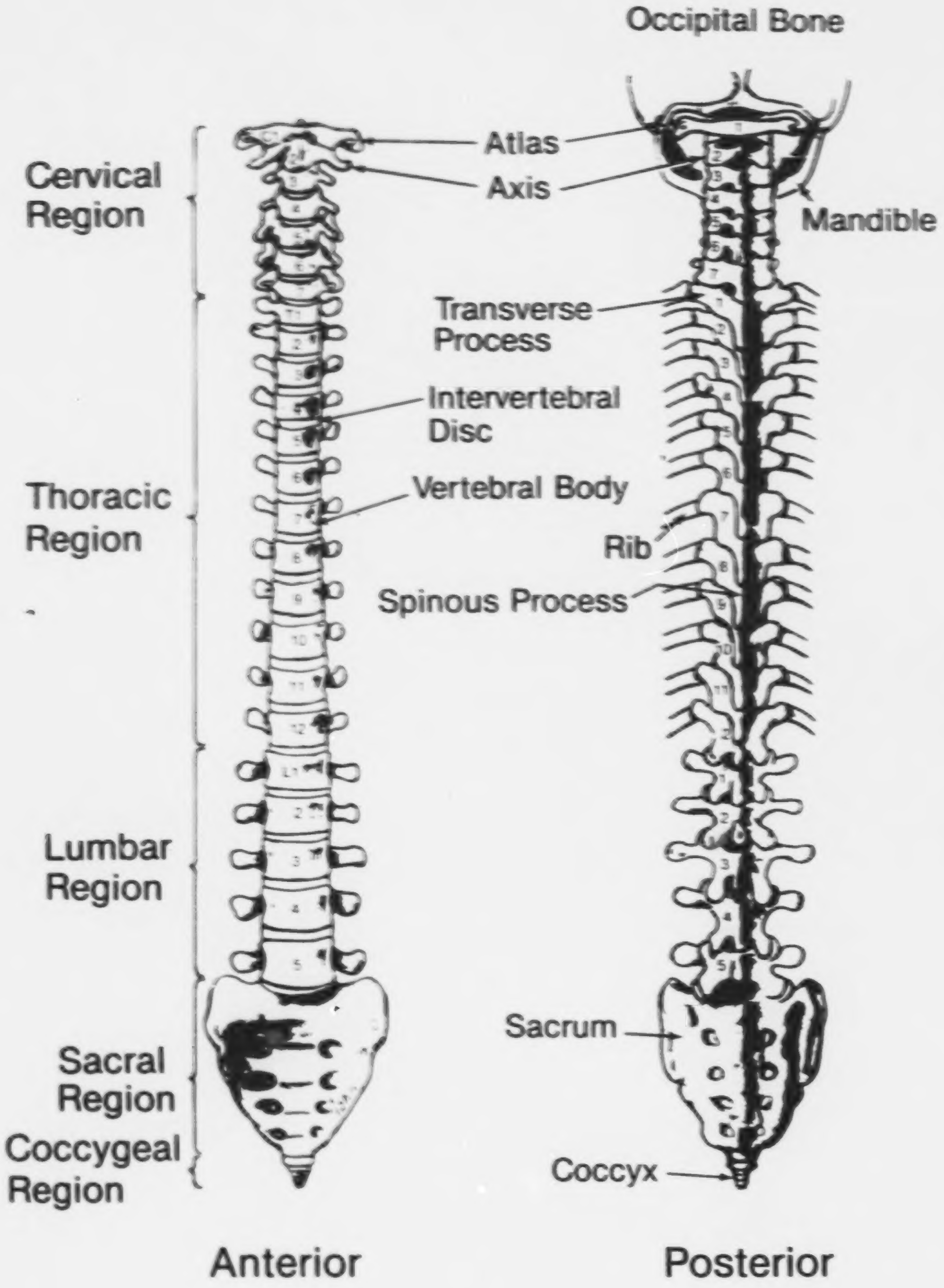
Note: Not all facial bones are shown here.

TM 5

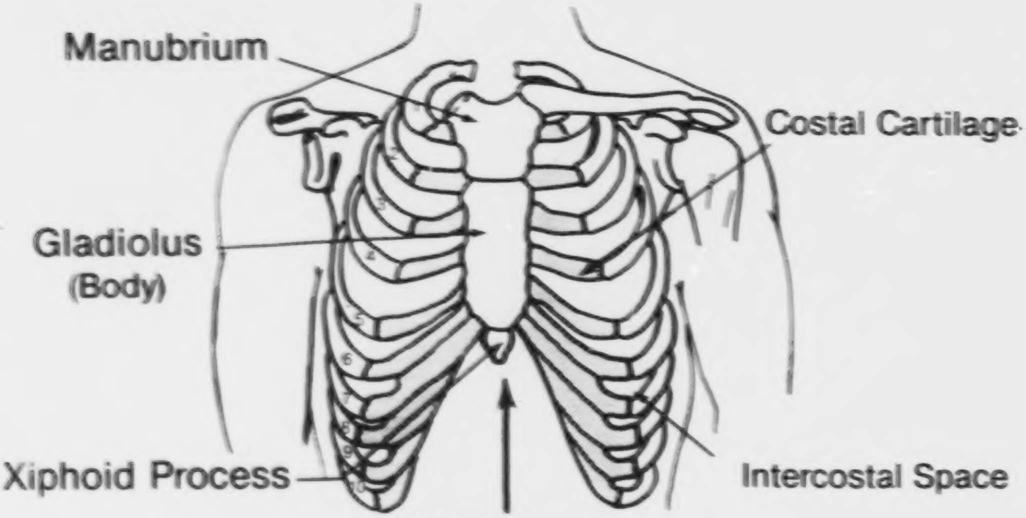
Bones of the Ear


Malleus
Incus
Stapes

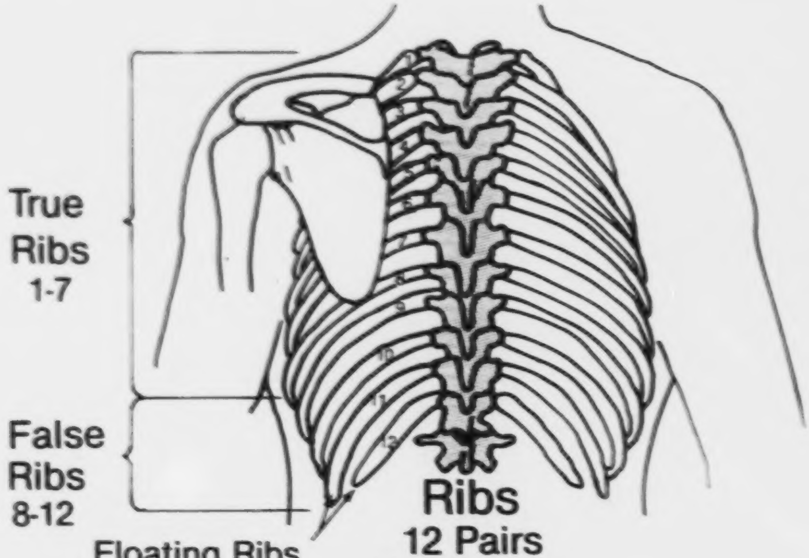
The Vertebral Column


Occipital Bone
Cervical Region
Atlas
Axis
Mandible
Transverse Process
Intervertebral Disc
Thoracic Region
Vertebral Body
Rib
Spinous Process
Lumbar Region
Sacral Region
Sacrum
Coccygeal Region
Coccyx
Anterior
Posterior

The Ribs and Sternum

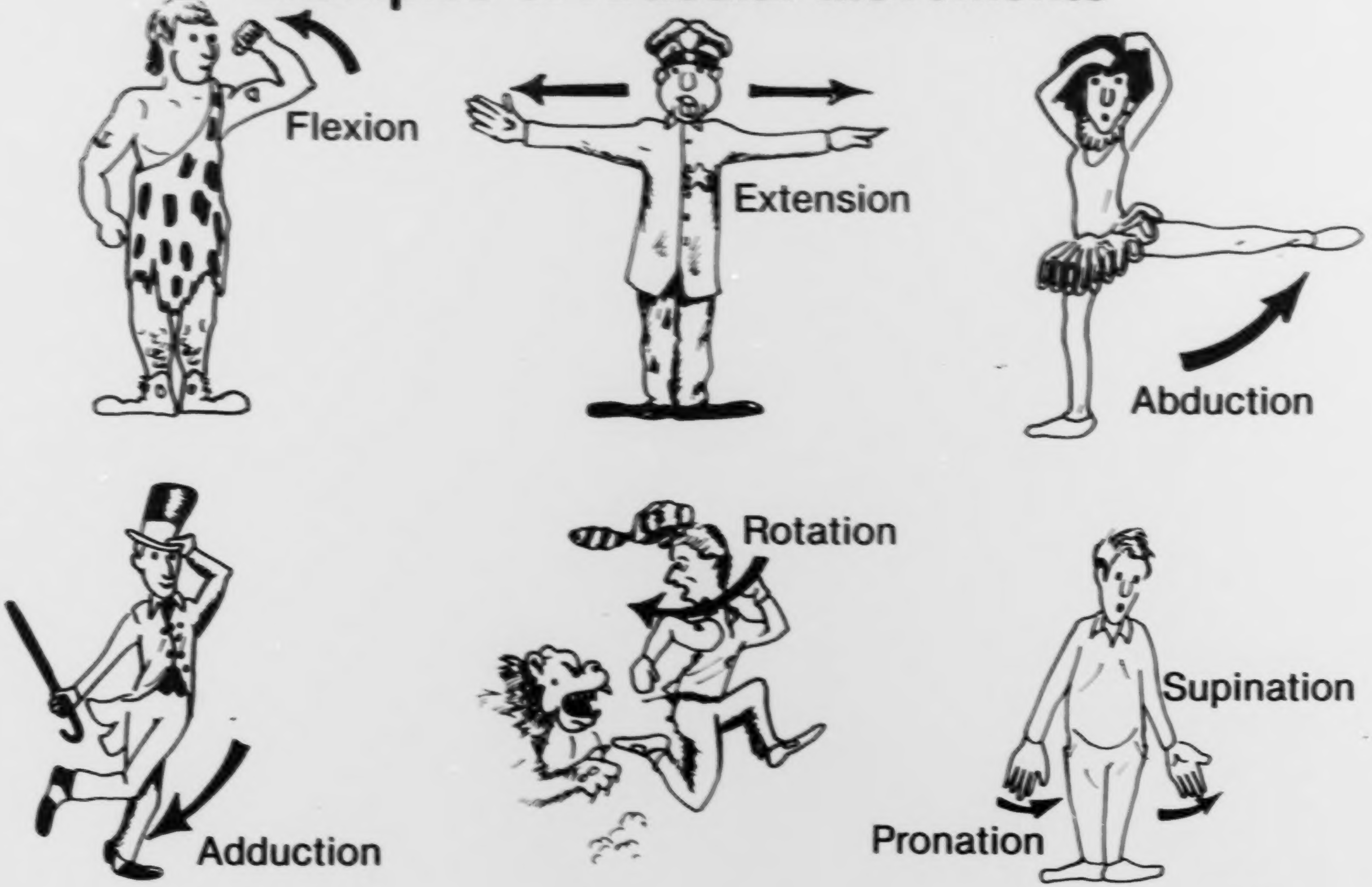

Manubrium
Costal Cartilage
Gladiolus
(Body)
Xiphoid Process
Intercostal Space
1
2
3
4
5
6
7
8
9
10

Sternum
Anterior


True
Ribs
1-7
False
Ribs
8-12
Floating Ribs
11-12
1
2
3
4
5
6
7
8
9
10
11
12

Ribs
12 Pairs
Posterior

Examples of Articular Movements


Flexion
Extension
Abduction
Rotation
Supination
Adduction
Pronation

Skeletal System
Unit 4

Information Sheet

1. Terms and definitions

   a. **Appendicular** — Pertaining to limbs or part appended to another part

   b. **Arthrology** — Science dealing with the study of joints

   c. **Articular system** — System of the body involving articulations (joints)

   d. **Articulation** — The connection of bones; a joint

   e. **Axial** — Pertaining to a line running through the center of a body; also pertaining to head and trunk

   f. **Bursa** — A padlike sac or cavity found in connective tissue usually near a joint which is lined with a synovial membrane and filled with synovial fluid which helps to reduce friction between moving parts

   g. **Cartilage** — A type of dense connective tissue consisting of cells embedded in a matrix which is firm, compact, and capable of withstanding pressure and tension

   h. **Fontanels** — Unossified spaces or soft spots lying between the cranial bones of the skull of a fetus or infant

   i. **Joint** — Point of junction between two bones

   j. **Ligament** — A band of fibrous connective tissue connecting bones, cartilages, and other structures and serving for support or for attachment of fascia or muscles

   k. **Olecranon process** — An extension at the proximal end of the ulna

   l. **Os** — Bone

   Example: Os hyoideum (the hyoid bone)

   m. **Ossicle** — Any small bone (especially one of the small bones in the ear)

   n. **Osteology** — Science dealing with the study of bones

   o. **Process** — A projection or outgrowth of bone or tissue

Information Sheet

p. **Skeletal system** — System of the body involving the bones, joints, and their attachments

q. **Sutures** — Lines of union of cranial bones by a thin fibrous membrane which eventually disappears

r. **Xiphoid process** — Thin, elongated process extending caudally from body of sternum

2. **Functions of the skeletal system**

a. Provides support and gives shape to the body

b. Protects the delicate, vital organs

Examples: Brain is protected by the skull. Heart and lungs are protected by the ribs.

c. Assists in body movement (with joints and muscles)

Note: Bones, with their joints, constitute levers. Muscles are anchored firmly to the bones. As muscles contract, force is applied to the bony levers and movement results.

d. Manufactures blood cells in the red bone marrow

Note: These include all the red blood cells (in the adult), most of the white blood cells, and the platelets.

e. Stores calcium and phosphorus

3. **Types of bones classified according to shape and specific bones which belong to those categories**

a. **Long bones**

(1) Femur

(2) Tibia

(3) Fibula

(4) Humerus

(5) Radius

(6) Ulna

Information Sheet

(7) Metacarpals

(8) Metatarsals

(9) Phalanges

b. **Short bones**

(1) Carpals

(2) Tarsals

c. **Flat bones**

(1) Several cranial bones (frontal and parietal)

(2) Ilium

(3) Ribs

(4) Scapula

d. **Irregular bones**

(1) Vertebrae

(2) Sphenoid

(3) Ethmoid

(4) Sacrum

(5) Coccyx

(6) Mandible

e. **Sesamoid**

Note: This is a small nodular bone embedded in a tendon or joint capsule.

(1) Patella

(2) Bones found between carpals and metacarpals, and tarsals and metatarsals

Information Sheet

4. **Composition of bones**
   - a. Inorganic salts such as calcium and phosphorus
   - b. Organic materials such as bone cells, blood vessels, nerves, and cartilage
   - c. Water
5. **Types of bone markings and their descriptions**
   - a. **Depressions and openings**
     - (1) Fossa — A hollow or depression
     - (2) Sinus — A cavity or spongelike space in a bone (frontal) which is mucous-lined and filled with air spaces
     - (3) Foramen — A hole
     - (4) Meatus — A tube-shaped opening
   - b. **Projections or processes which fit into joints**
     - (1) Condyle — A rounded projection that enters into formation of a joint

       Example: Femoral condyle into knee joint
     - (2) Head — A rounded projection beyond a narrow neckline portion

       Example: Head of femur
   - c. **Projections or processes to which muscles attach**
     - (1) Trochanter — A very large process

       Example: Greater trochanter of femur (near the head of the femur)
     - (2) Crest — A ridge

       Example: Iliac crest
     - (3) Spinous process or spine — A sharp projection

       Example: Anterior, posterior iliac spine
     - (4) Tuberosity — A large, rounded projection

       Example: Ischial tuberosity
     - (5) Tubercle — A small, rounded projection

       Example: Rib tubercle

Information Sheet

6. **Structures of a long bone** (Figure 1)

   a. Diaphysis

   b. Epiphysis

   c. Articular cartilage

   d. Periosteum

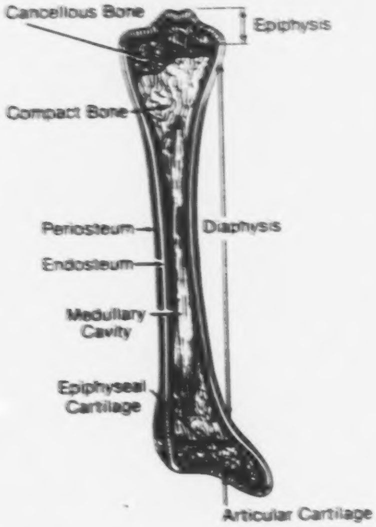
   e. Medullary cavity

   f. Endosteum

   g. Compact bone

   h. Cancellous bone

Figure 1—Structures of a long bone


Cancellous Bone
Epiphysis
Compact Bone
Periosteum
Diaphysis
Endosteum
Medullary Cavity
Epiphyseal Cartilage
Articular Cartilage

Information Sheet

7. **Components making up the structure of bones and their descriptions**

   a. **Diaphysis** — The main shaftlike portion of a bone

   b. **Epiphysis** — Bulbous-shaped extremities of long bones that provide generous space for muscle attachments near the joints; bone growth occurs here

   c. **Metaphysis** — Wide part at the extremity of the shaft of a long bone that supports the epiphysis

   Note: In an adult, it is continuous with the epiphysis.

   d. **Articular cartilage** — Thin cartilage covering the articular surface of each epiphysis that cushions jars and blows

   e. **Periosteum** — The fibromuscular membrane that covers the bone except at joint surfaces where the articular cartilage forms the covering; also nourishes the bone

   Note: It is thick and vascular in young bones, thinner and less vascular later in life.

   f. **Medullary cavity** — A cavity running the length of the diaphysis which contains bone marrow

   g. **Endosteum** — A condensed layer of bone marrow which lines the medullary cavity

   h. **Compact bone** — The hard bone that is found outside the medullary cavity in the shaft of long bones

   Note: The bone that carries the greatest amount of body weight must have a greater amount of compact bone.

   i. **Cancellous bone** — The spongy tissue found in the epiphyseal portion of long bones

   j. **Bone marrow** — The medulla or soft tissues in the hollow of long bones and medullary cavities and in the extremities of long bones; may be red or yellow

   k. **Foramen** — A hole in the bone for passage of vessels or nerves

   Note: This is sometimes called the nutrient foramen.

Information Sheet

8. **Characteristics of bone marrow**

   a. Is a soft spongelike material found in cavities of bones

   b. Is a network of blood vessels and special connective tissue that holds together fat and blood-producing cells

   c. Manufactures red blood cells (rbc), white blood cells (wbc), and platelets

      Note: Blood cells normally do not enter the blood stream until fully developed. If the body needs more red or white blood cells, then the marrow speeds up production.

   d. Consists of two types

      (1) Red bone marrow produces the blood cells.

      (2) Yellow bone marrow is mainly composed of fatty tissue and normally has no blood-producing function.

   e. During infancy and childhood, all bone marrow is red. Gradually as one gets older and less blood-cell production is needed, the fat content of marrow increases and turns marrow from red to yellow.

   f. In adulthood, red marrow is contained in only a few locations.

      (1) Diploe

      Note: This is the spongy bone of cranial bones found between the layers or tables of the skull.

      (2) Ribs and sternum

      (3) Vertebral bodies

      (4) Proximal epiphysis of the humeri and femurs

   g. Red bone marrow, because of its blood cell producing capability, is considered one of the most important materials in the body and receives maximum protection by lying within the bones.

   h. Yellow bone marrow, found within the medullary cavity of long bones, is composed of fatty connective tissue which supports blood vessels and cells.

Information Sheet

9. **Two parts of human skeleton**

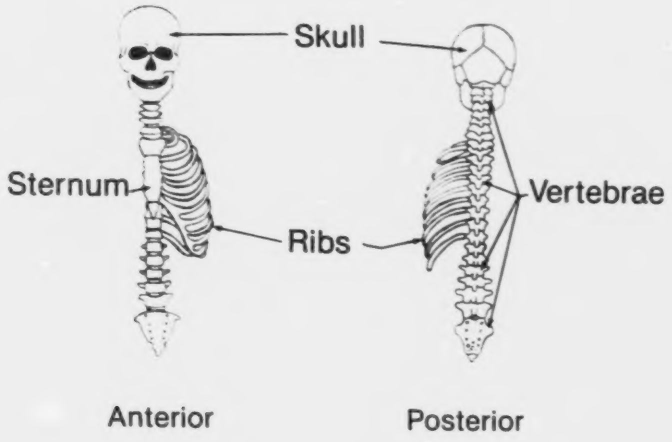
   a. **Axial skeleton** (Figure 2)

      (1) Is composed of 80 bones

      (2) Forms the upright part or axis of the body

      (3) Consists of the hyoid, skull, vertebral column, ribs, and sternum

Figure 2—Axial skeleton


Skull
Sternum
Vertebrae
Ribs
Anterior
Posterior

Information Sheet

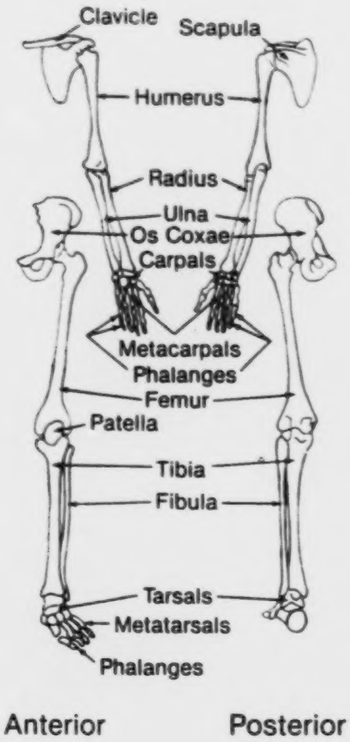
b. **Appendicular skeleton** (Figure 3)

(1) Is composed of 126 bones

(2) Is attached to the axis as appendages

(3) Consists of the shoulder and pelvic girdles, and the upper and lower extremities

Figure 3—Appendicular skeleton


Clavicle
Scapula
Humerus
Radius
Ulna
Os Coxae
Carpals
Metacarpals
Phalanges
Femur
Patella
Tibia
Fibula
Tarsals
Metatarsals
Phalanges
Anterior
Posterior

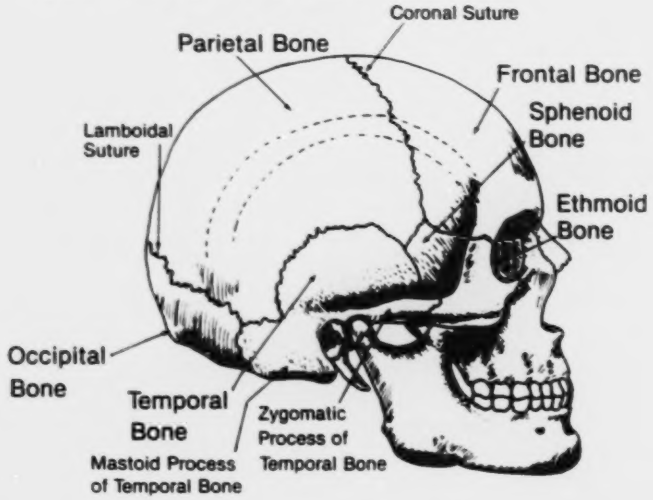
10. **Bones of the skull** — 28 bones

Note: These bones protect the brain, provide facial features, perform chewing function, and make speech possible.

a. Cranium — 8 bones (Figure 4)

NAME OF BONE	NUMBER	LOCATION
1. Frontal	1	Forehead bone
2. Parietal	2	Top of cranium behind the frontal bone
3. Temporal	2	Lower sides of cranium which contain middle and inner ear structures
4. Occipital	1	Posterior part of cranium
5. Sphenoid	1	Lies crosswise through the mid-portion of the cranium; contains the *sella turcica* (Turks' saddle) which is a saddle-shaped depression on the upper surface of the sphenoid body that contains the pituitary gland
6. Ethmoid	1	Lies posterior to nasal bones and anterior to sphenoid

Figure 4—Bones of the cranium

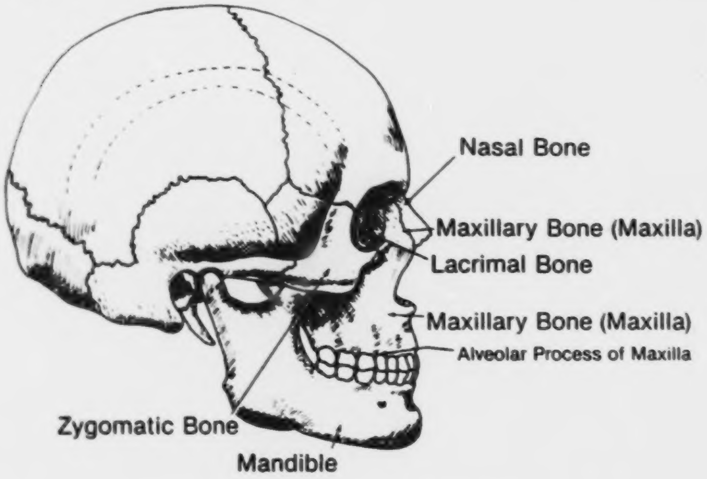

Coronal Suture
Parietal Bone
Frontal Bone
Sphenoid Bone
Lamboidal Suture
Ethmoid Bone
Occipital Bone
Temporal Bone
Zygomatic Process of Temporal Bone
Mastoid Process of Temporal Bone

Information Sheet

b. Face — 14 bones (Figure 5)

NAME OF BONE	NUMBER	LOCATION
1. Nasal	2	Small bones forming upper part of bridge of the nose
2. Maxillary (Maxilla)	2	Upper jaw bones
3. Zygomatic	2	Cheek bones
4. Mandible	1	Lower jaw bone
5. Lacrimal	2	Posterior and lateral to nasal bones; form side walls of nasal cavity
6. Palatine	2	Posterior part of hard palate, and floor and part of side walls of nasal cavity
7. Inferior conchae (turbinates)	2	Inner surface side wall and nasal cavity; above roof of mouth
8. Vomer	1	Lower and posterior part of nasal septum

Figure 5—Bones of the face


Nasal Bone
Maxillary Bone (Maxilla)
Lacrimal Bone
Maxillary Bone (Maxilla)
Alveolar Process of Maxilla
Zygomatic Bone
Mandible

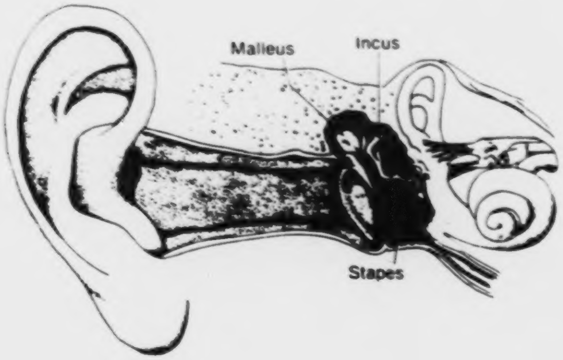
Note: Not all facial bones are shown here.

Information Sheet

c. Ear — 6 ossicles (Figure 6)

NAME OF BONE	NUMBER	LOCATION	SHAPE
1. Malleus	2	Middle ear	Hammer-shaped
2. Incus	2	Middle ear	Anvil-shaped
3. Stapes	2	Middle ear	Stirrup-shaped

Figure 6—Bones of the ear



11. Characteristics of the hyoid bone

a. Is one, u-shaped bone in neck between mandible and upper part of larynx

b. Only bone in the body which does not articulate with another bone

c. Suspended by ligaments on processes from temporal bone in cranium

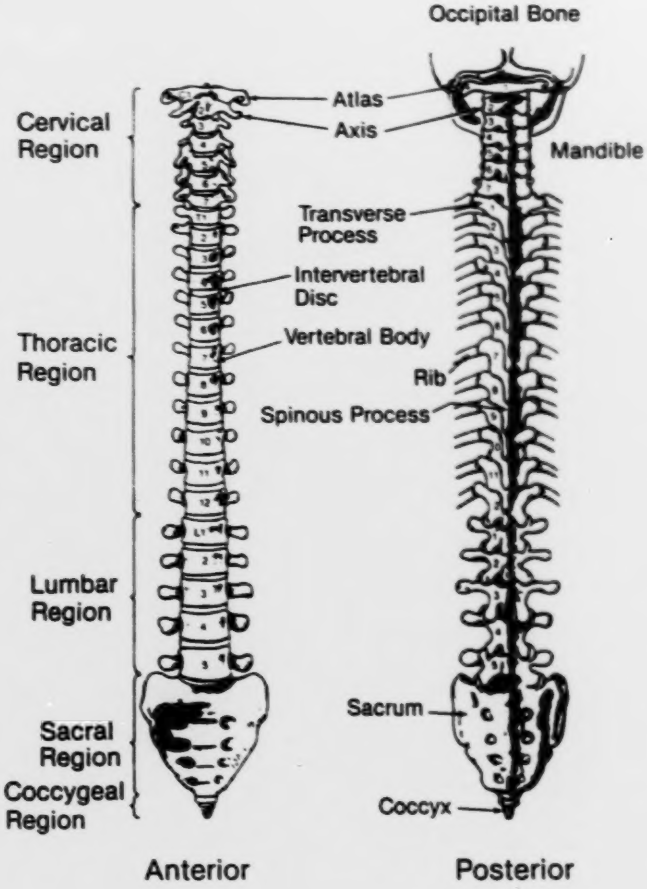
d. Tongue is connected to it.

Information Sheet

12. **Regions and bones of the vertebral column** — 26 bones (Figure 7)

Note: The vertebral column protects the spinal cord, provides support for the torso, and is divided into 5 regions.

Figure 7—The vertebral column


Occipital Bone
Atlas
Axis
Mandible
Cervical Region
Transverse Process
Intervertebral Disc
Vertebral Body
Thoracic Region
Rib
Spinous Process
Lumbar Region
Sacrum
Sacral Region
Coccygeal Region
Coccyx
Anterior
Posterior

Information Sheet

a. **Cervical region**

(1) Consists of the first or upper 7 vertebrae (7 bones)

(2) Individual vertebrae (bones) in the region are identified by the letter C (for cervical) and by their number 1 through 7 depending on their location.

Example: Injury to C4 (fourth vertebra in the cervical region)

(3) First cervical vertebra is called the atlas which supports the skull, articulates with the axis, allows for flexion, extension, and rotation of the head, and is numbered C1.

(4) Second cervical vertebra is called the axis which articulates with the atlas to form a pivot joint to allow for side-to-side rotation of the head; it is numbered C2.

b. **Thoracic region**

(1) Consists of the next 12 vertebrae

(2) Vertebrae are identified by the letter T and their number 1 through 12.

(3) Twelve pairs of ribs attach to these to form the thoracic cavity.

c. **Lumbar region**

(1) Consists of the next 5 vertebrae

(2) Vertebrae are identified by the letter L and their number 1 through 5.

(3) Functions as the "workhorse" of the body

d. **Sacral region**

(1) Consists of 1 wedge-shaped bone, the sacrum

(2) Formed by the fusion of 5 separate vertebrae found in the embryo

e. **Coccygeal region**

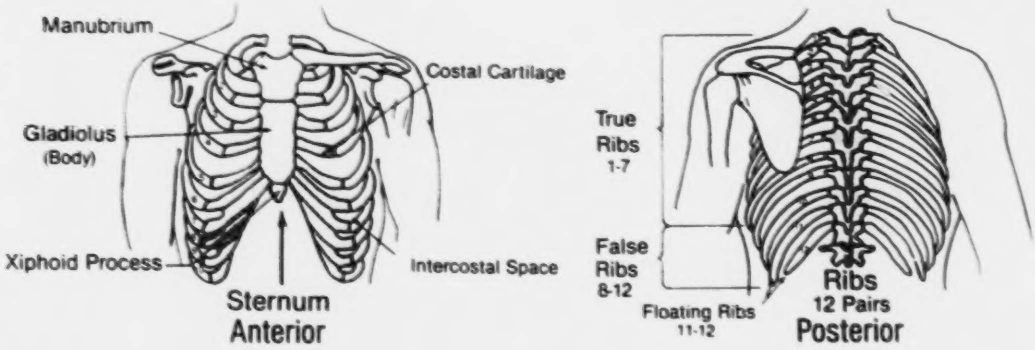
(1) Consists of 1 bone, the coccyx

(2) Formed by the fusion of 4 separate vertebrae found in the embryo

Information Sheet

13. **Characteristics of the ribs and sternum** — 25 bones (Figure 8)

Figure 8


Manubrium
Costal Cartilage
Gladiolus
(Body)
Xiphoid Process
Intercostal Space
Sternum
Anterior
True
Ribs
1-7
False
Ribs
8-12
Floating Ribs
11-12
Ribs
12 Pairs
Posterior

a. The ribs and sternum form the thoracic cavity.

b. There are 12 pairs of ribs (24 bones).

c. All ribs attach to the thoracic region of the vertebral column.

d. The upper 7 pairs of ribs are called "true ribs."

e. "True ribs" are attached to the sternum by costal cartilages.

f. The lower 5 pairs of ribs are called "false ribs."

g. "False ribs" do not attach to the sternum directly.

h. The upper 3 pairs of false ribs attach to the seventh costal cartilage.

i. The lower 2 pairs of false ribs do not attach at all and are called "floating ribs."

j. The sternum is one bone that is also called the breast bone.

k. The sternum contains three divisions.

   (1) Manubrium — Upper part

   (2) Gladiolus — Body

   (3) Xiphoid process — Lower part

Information Sheet

14. Bones of the appendicular skeleton (126 bones)

Note: Refer back to Figure 3 for identification of these bones.

NAME OF BONE	NUMBER	LOCATION
Clavicle	2	Collar bone
Scapula	2	Shoulder blade
Humerus	2	Long bone in upper arm
Radius	2	Long bone on thumb side of forearm
Ulna	2	Long bone on little finger side of forearm; is longer than radius
Carpals	16	Wrist bones
Metacarpals	10	Long bones forming the framework of the palm of the hand
Phalanges	28	Miniature long bones of fingers; three in each finger, two in each thumb
Os coxae or os innominatum	2	Large innominate bones which, together with the sacrum and coccyx, make up the pelvis; early in life each innominate bone consists of three separate bones—the ilium, ischium, and pubis. In an adult these three bones are fused into a single, massive bone
Femur	2	Thigh bone; longest, strongest bone in the body
Patella	2	Knee cap; largest sesamoid bone in the body
Tibia	2	Shin bone; largest bone in lower leg
Fibula	2	Long, slender bone on lateral side of lower leg
Tarsals	14	Ankle bones which form heel and proximal or posterior half of foot
Metatarsals	10	Long bones which form the framework of the sole of the foot
Phalanges	28	Miniature, long bones of toes; two in each great toe, three in other toes

Information Sheet

15. **Functions of the articular system**

    a. Joints allow for changes of position and body motion.

    b. Joints help to bear weight of the body.

    c. The joint capsule, ligaments, tendons, muscles, and articular disks provide stability.

    d. Synovial fluid lubricates the joints and nourishes the cartilages.

16. **Components of articular structure**

    a. **Ligaments**

    (1) Are connective tissue bands which hold bones together

    (2) Are found in connection with all the freely movable joints, and in many of the less movable joints

    (3) Help to reinforce and stabilize the joints at various points

    Note: When ligaments completely enclose the joint, they are called capsular ligaments.

    b. **Articular cartilages**

    (1) Are smooth layers of cartilage that cover the ends of opposing bones

    (2) Are found where bones meet adjacent bones

    (3) Provide a smooth, gliding surface for opposing bones (with synovial fluid)

    c. **Synovial fluid**

    (1) A thick, colorless fluid that resembles the white of a raw egg

    (2) Is secreted by the synovial membrane which is a thick, vascular connective tissue lining the inner surface of the joint capsule

    (3) Acts as a shock absorber

    (4) Provides smooth articulating surface for the adjacent bone

    (5) Provides the major source of nutrition for the articular cartilage

Information Sheet

17. Articular classifications

Name	Degree of Movement	Characteristics	Examples
Synarthroses (Fibrous joints)	Immovable	• Do not have a joint cavity • Fibrous cartilage or bone tissue grows between the articulating surfaces	• Sutures of the skull • Facial bones except mandible • Distal tibiofibular joint
Amphiarthroses (Cartilaginous joints)	Slightly movable	• Held together by cartilage • Two types: (1) Symphyses — "A growing together" of bones at body midline (2) Synchondroses — Held together with cartilage	(1) Symphysis pubis (between pubic bones) and joints between the vertebrae (2) Joints between ribs and sternum held together by costal cartilages
Diarthroses (Synovial joints)	Freely movable	• Have a joint cavity enclosed by articular capsule • Have ligaments that cover and connect the ends of opposing bones • Have synovial fluid • Are divided into six classes	• Hip and femur joint • Knee joint • Wrist joint • Elbow joint • Shoulder joint

Information Sheet

18. **Types of movable joints**

    a. **Ball and socket joint**

        (1) The ball-shaped head fits into a concave socket.

        (2) Provides the widest range of motion, with movement in all planes in addition to rotation

        (3) Examples include hip and femur (acetabulum) and humerus and glenoid cavity of scapula (shoulder joint).

        Note: The shoulder joint is the most freely movable joint in the body.

    b. **Hinge joint**

        (1) A convex surface fits into a concavity.

        (2) Has an angular movement in one direction, like a door on hinges.

        (3) Motion is limited to flexion and extension in a single plane.

        (4) Examples include knee joint, elbow joint, and finger joint.

    c. **Pivot joint**

        (1) A pivot-like process rotates within a bony fossa around a longitudinal axis.

        (2) Motion is limited to uniaxial rotation.

        (3) Example includes articulation between axis and atlas for rotation of head and the joint between radius and ulna (the radial head rotates to pronate or supinate the hand).

    d. **Condyloid (ellipsoidal) joint**

        (1) An oval-shaped condyle fits into an elliptical cavity.

        (2) Motion is possible in two planes at right angles to each other.

        (3) Example is the wrist joint between radius and carpal bones.

Information Sheet

e. **Saddle joint**

   (1) Articular surface of each bone is concave in one direction and convex in another.

   (2) Similar in function to condyloid joints with movement possible in two directions.

   (3) Example is the joint between the carpals and thumb metacarpals.

f. **Gliding joint**

   (1) Articular surfaces are flat, or slightly concave, and the other slightly convex.

   (2) Permits a gliding movement only — nonaxial.

   (3) Examples include joints between carpals and between tarsals.

19. **Types of articular movements and their descriptions** (Figure 9)

   a. **Flexion** — Bending or decreasing the angle between two bones

   b. **Extension** — Straightening or increasing the angle between two bones

   c. **Abduction** — Moving the bone away from the midline

   d. **Adduction** — Moving the bone toward the midline

   e. **Rotation** — Moving the bone around a central axis; the plane of motion is perpendicular to the axis

   f. **Circumduction** — Moving the bone so that the end of it describes a circle and the sides of it describe a cone

   g. **Supination** — Moving the bones of the forearm so that the radius and ulna are parallel; the palm is moved from a posterior to an anterior position

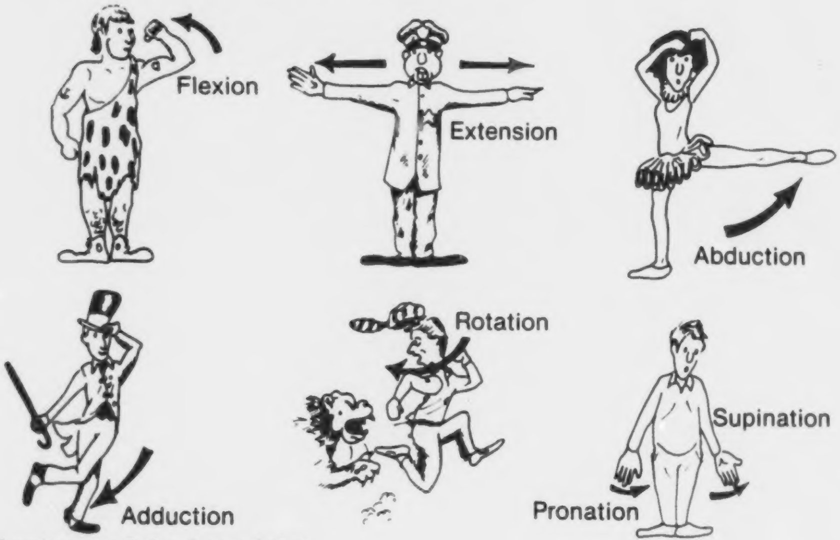
   h. **Pronation** — Moving the bones of the forearm so that the radius and ulna are not parallel; the palm is moved from an anterior to a posterior position

   i. **Eversion** — Moving the sole of the foot outward at the ankle joint

   j. **Inversion** — Moving the sole of the foot inward at the ankle joint

Information Sheet

Figure 9—Articular movements


Flexion
Extension
Abduction
Rotation
Supination
Adduction
Pronation

20. Anatomy of the knee joint

Note: Knee joint stability depends on strong ligaments and strong muscles of the thigh.

a. **Two semilunar cartilages**

(1) Medial meniscus

(2) Lateral meniscus

b. **Two main sets of ligaments**

(1) Anterior and posterior cruciate ligaments

(2) Fibular and tibial collateral ligaments

Note: These are also called medial and lateral collateral ligaments.

Skeletal System
Unit 4

Student Supplement 1—Classify Bones According to Type

Name ______________________________

Directions: Classify each of the following bones according to type (shape).

Example: Ribs — Flat bones

1. Carpals — ______________________________
2. Radius — ______________________________
3. Patella — ______________________________
4. Scapula — ______________________________
5. Femur — ______________________________
6. Fibula — ______________________________
7. Sacrum — ______________________________
8. Tarsals — ______________________________
9. Vertebrae — ______________________________
10. Phalanges — ______________________________

Skeletal System
Unit 4

Student Supplement 2—Draw and Label a Long Bone

Name ____

Directions: Draw a diagram of a long bone and label the following parts: diaphysis, epiphysis, articular cartilage, periosteum, medullary cavity (marrow), endosteum, compact bone, and cancellous bone.

Skeletal System
Unit 4

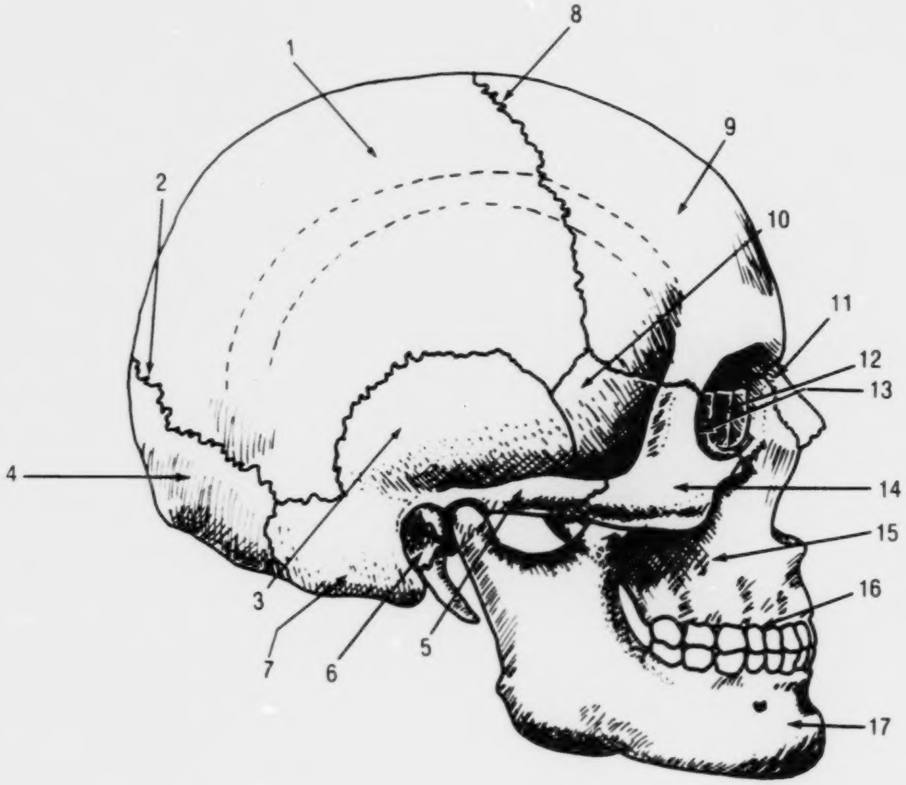
Student Supplement 3—Identify the Bones of the Skull

Name ____

Directions: Identify the bones of the skull in the following illustration by writing the number of the part in the blank by the name of the part.

______a. Ethmoid bone
______b. Zygomatic process of temporal bone
______c. Parietal bone
______d. Nasal bone
______e. Coronal suture
______f. Sphenoid bone
______g. Mandible
______h. Lacrimal bone
______i. Alveolar process of maxilla

______j. Temporal bone
______k. Zygomatic bone
______l. External auditory meatus
______m. Frontal bone
______n. Occipital bone
______o. Lamboidal suture
______p. Maxilla
______q. Mastoid process of temporal bone



A&P-87

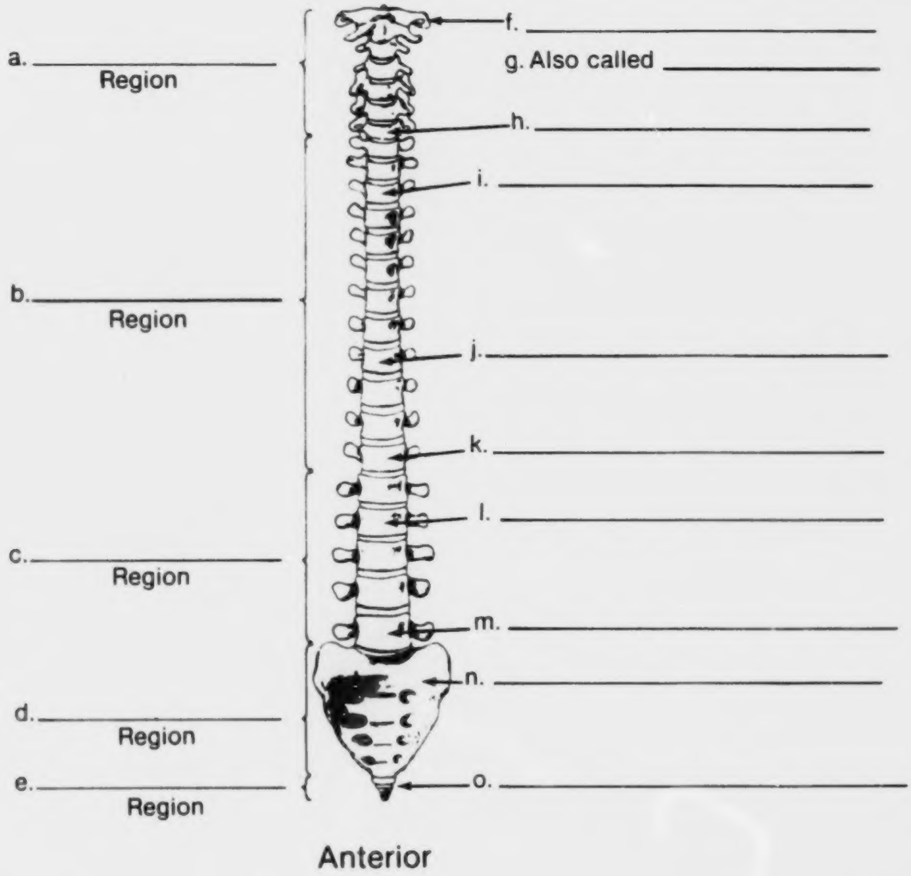
Skeletal System
Unit 4

Student Supplement 4—Identify Regions and Bones of the Vertebral Column

Name ______________________________

Directions: Identify the regions and bones in the following illustration of the vertebral column.

Note: Remember that vertebrae are identified by a letter **and** a number unless they have a specific name.


a. ____________ Region
b. ____________ Region
c. ____________ Region
d. ____________ Region
e. ____________ Region
f. ____________
g. Also called ____________
h. ____________
i. ____________
j. ____________
k. ____________
l. ____________
m. ____________
n. ____________
o. ____________
Anterior

Skeletal System
Unit 4

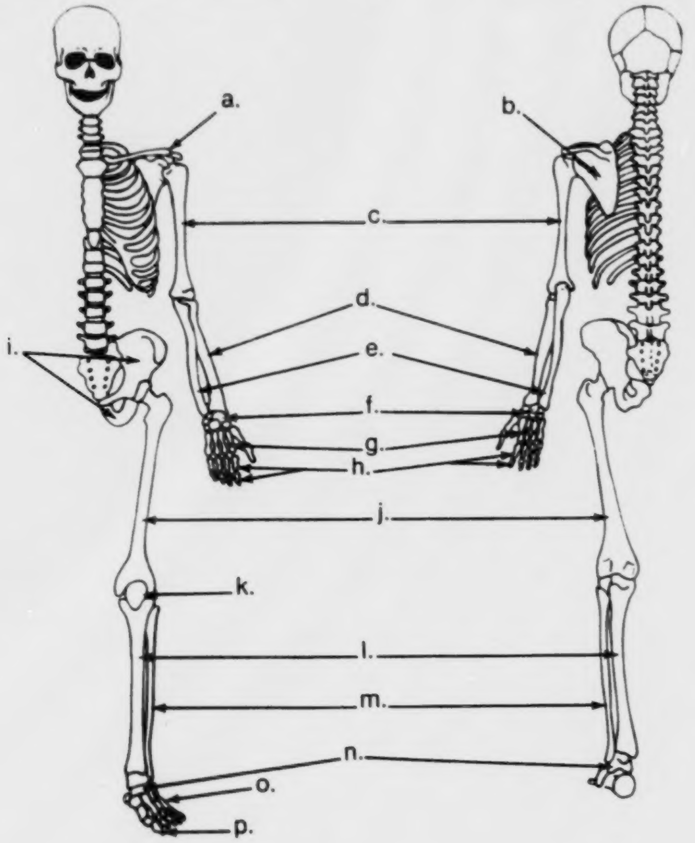
Student Supplement 5—Identify the Bones of the Appendicular Skeleton

Name ____

Directions: Identify the bones in the following illustration and place your answers in the blanks provided.

a. ______________________________
b. ______________________________
c. ______________________________
d. ______________________________
e. ______________________________
f. ______________________________
g. ______________________________
h. ______________________________

i. ______________________________
j. ______________________________
k. ______________________________
l. ______________________________
m. ______________________________
n. ______________________________
o. ______________________________
p. ______________________________



Skeletal System
Unit 4

Student Supplement 6—Complete Statements Concerning the Skeletal System

Name ______________________________

Directions: Complete the following statements by placing the correct letter in the blanks provided.

_____ 1. Another name for bone is

a. Os
b. Process
c. Diaphysis
d. Articulation

_____ 2. The skeletal system stores

a. Nitrogen
b. Hemoglobin
c. Iodine
d. Calcium

_____ 3. All of the following are types of bones **EXCEPT**

a. Thick
b. Thin
c. Short
d. Long

_____ 4. Which of the following would be classified as a long bone?

a. Rib
b. Femur
c. Sacrum
d. Carpals

_____ 5. A hole in a bone is called a

a. Crest
b. Fossa
c. Foramen
d. Tubercle

Student Supplement 6

______ 6. There are 126 bones in the ____________ skeleton.

a. Articular
b. Axial
c. Appendicular
d. Entire

______ 7. There are ____________ bones in the thumb.

a. 2
b. 3
c. 4
d. 5

______ 8. The first cervical vertebra is called

a. Axis
b. Atlas
c. Acetabulum
d. Apex

______ 9. Bone growth occurs in the

a. Diaphysis
b. Endosteum
c. Periosteum
d. Epiphysis

______ 10. A common name for the tibia is

a. Ankle bone
b. Collar bone
c. Thigh bone
d. Shin bone

______ 11. The breast bone is the

a. Sternum
b. Scapula
c. Clavicle
d. Humerus

______ 12. The part of the bone that manufactures red blood cells is called

a. Periosteum
b. Red marrow
c. Yellow marrow
d. Compact bone marrow

Student Supplement 6

______13. The 2 pairs of floating ribs

a. Articulate anteriorly with each other
b. Do not articulate anteriorly with anything
c. Articulate anteriorly with the sternum
d. Articulate anteriorly with the 8th-9th-10th pairs of ribs

______14. Another name for the forehead bone is

a. Frontal
b. Parietal
c. Temporal
d. Occipital

______15. What bone forms the central side of the cranium around the ear?

a. Frontal
b. Parietal
c. Temporal
d. Occipital

______16. The upper vertebrae in the neck region are the

a. Seven lumbar vertebrae
b. Seven cervical vertebrae
c. Twelve thoracic vertebrae
d. Twelve cervical vertebrae

______17. The bones of the ankle are the

a. Carpals
b. Tarsals
c. Zygomae
d. Hyoids

______18. The upper teeth are embedded in the

a. Mandible
b. Maxilla
c. Zygoma
d. Mastoid process

______19. The cheek bones are called the

a. Tubinates
b. Vomers
c. Maxillary bones
d. Zygomatic bones

Student Supplement 6

______20. Which of the following two bones make up the shoulder girdle?

a. Scapula and humerus
b. Humerus and clavicle
c. Clavicle and scapula
d. Sternum and scapula

______21. The os coxae is formed in early life from the following bones: ilium,

a. Ischium, and pubis
b. Ischium, and sacrum
c. Sacrum, and pelvis
d. Sacrum, and coccyx

______22. The long bone on the little finger side of the forearm is called the

a. Radius
b. Humerus
c. Fibula
d. Ulna

______23. How many pairs of ribs are there?

a. 7
b. 12
c. 24
d. 8

______24. Places where the cranial bones have not yet come together in the infant are called

a. Fissures
b. Sulci
c. Fontanels
d. Sutures

Skeletal System
Unit 4

Student Supplement 7—Complete Statements Concerning the Articular System

Name ____

Directions: Complete the following statements by placing the correct letter in the blanks provided.

______ 1. All of the following are types of joints **EXCEPT**

a. Triarthroses
b. Diarthroses
c. Synarthroses
d. Amphiarthroses

______ 2. Cartilaginous joints are called

a. Triarthroses
b. Diarthroses
c. Synarthroses
d. Amphiarthroses

______ 3. Movable joints are filled with a fluid that acts as

a. An adhesive to hold bones together
b. A passageway for nutrients
c. A barrier against infection
d. A lubricant to prevent friction

______ 4. The knee joint is an example of a

a. Ball-and-socket joint
b. Hinge joint
c. Pivot joint
d. Gliding joint

______ 5. The end of one bone can move smoothly over the end of another bone because the joint lining produces

a. Tissue fluid
b. A lubricating oil
c. A smooth cartilage
d. Synovial fluid

Student Supplement 7

______ 6. The kind of joint located between two bone ends will determine the

a. Work the body part can do
b. Efficiency of the body part
c. Amount of movement possible for the body part
d. Amount of body weight the body part can carry

______ 7. The shoulders are an example of which type of joint?

a. Ball-and-socket
b. Pivot
c. Hinge
d. Saddle

______ 8. Full movement in all directions is a feature of the joint between the

a. Scapula and humerus
b. Femur and tibia
c. Phalanges and metacarpals
d. Cranium and vertebrae

______ 9. An immovable joint is a/an

a. Diarthrosis
b. Amphiarthrosis
c. Synarthrosis
d. Pivot joint

______10. The joint between the carpals is an example of a

a. Hinge joint
b. Gliding joint
c. Saddle joint
d. Pivot joint

Muscular System
Unit 5

Objective Sheet

Unit Objective

After completing this unit, the student should be able to distinguish between the three classifications of muscle tissue and identify the principal skeletal muscles and their functions. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the muscular system with their correct definitions.
2. Distinguish between the three classifications of muscle tissue.
3. Select major functions of the muscles.
4. Complete statements concerning muscle attachments.
5. Identify the parts of a muscle.
6. Match functional characteristics of muscle tissue with the correct descriptions.
7. Match types of muscles with the correct actions.
8. Complete statements concerning the action of the skeletal muscles.
9. Match muscle groups with the correct functions.
10. List criteria for remembering names of muscles.
11. Identify the principal skeletal muscles.
12. Match the principal skeletal muscles with the correct functions.

Muscular System
Unit 5

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Parts of a Muscle (Objective 5)
   TM 2—Coordinated Movement (Objective 8)
   TM 3—Muscles (Anterior View) (Objective 11)
   TM 4—Muscles (Posterior View) (Objective 11)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.
13. Make copies of the written test. Add or modify test items as needed.
14. Give written test.
15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.
16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Show the principal skeletal muscles to the students using a classroom model, wall chart, or diagram.
2. Discuss the coordinated movement of muscles using students as live models.
3. Discuss the criteria for remembering the names of muscles outlined in Objective 10 of the Information Sheet. During class discussion, name a muscle and have students discuss which of these criteria would be helpful.
4. Show diagrams of the smaller, secondary muscles of the body which are not included in this unit so students realize that they are learning only the principal skeletal muscles.
5. Discuss diseases such as muscular dystrophy and myasthenia gravis which affect muscles.
6. Discuss the steps individuals can take to help maintain their muscular system such as regular and sensible exercise, diet, rest, and proper body mechanics.

Suggested Activities

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.
2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.
3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.
4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Supplemental Resources

1. Videotapes
    a. *Muscle Power*
    b. *Moving Parts*

    Part of *The Living Body* Servies available from:

    Films for the Humanities and Sciences
    P.O. Box 2053
    Princeton, NJ 08543-2053
    800-257-5126 or 609-452-1128

2. Audiotape—*Skeletal and Muscular Systems*, part of the *Medical Terminology Made Easy* Series of audiotapes available from:

    Health Sciences Consortium
    201 Silver Cedar Court
    Chapel Hill, NC 27514-1517
    919-942-8731

Suggested Activities

3. Software programs

   a. *Skeletal Muscle Anatomy and Physiology*, 3 disks, for Apple II's. Available from:

      Queue, Inc.
      338 Commerce Drive
      Fairfield, CT 06430
      800-232-2224

   b. *Muscle, the Spinal Cord, and Peripheral Nervous System* (Module 7), part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

      Health Sciences Consortium
      201 Silver Cedar Court
      Chapel Hill, NC 27514-1517
      919-942-8731

4. Anatomy charts and models on the muscular system are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
      P.O. Box 21207
      Waco, TX 76702-1207
      800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
      3823 Leavenworth Street
      Omaha, NB 68105
      800-228-7117

Muscular System
Unit 5

Answers to Student Supplements

Student Supplement 1

a. Orbicularis oris
b. Deltoid
c. Pectoralis major
d. Serratus anterior
e. Biceps brachii
f. Adductors
g. Soleus
h. Orbicularis oculi
i. Masseter
j. Sternocleidomastoid
k. Intercostals
l. Rectus abdominis
m. External oblique
n. Internal oblique
o. Transversus abdominis
p. Sartorius
q. Quadriceps femoris
r. Peroneus longus
s. Tibialis anterior
t. Trapezius
u. Deltoid
v. Latissimus dorsi
w. Gluteus maximus
x. Gastrocnemius
y. Triceps brachii
z. Hamstrings

Student Supplement 2

1. d
2. b
3. a
4. c
5. a
6. a
7. b
8. d
9. b
10. d
11. b
12. b
13. b
14. b
15. d
16. c
17. a
18. d
19. b
20. d
21. a
22. d
23. d
24. c
25. a
26. d
27. a
28. a
29. a
30. d
31. a
32. b
33. c
34. d
35. d
36. d
37. d
38. d
39. d
40. d
41. c
42. d
43. d
44. a

Information Sheet

10. Criteria for remembering names of muscles

Note: It is easier to remember the names of muscles if you take into consideration the criteria listed below. They describe a feature of the muscle.

a. Action

Example: Extensor digotorum longus muscle

b. Shape

Examples: Trapezius (trapezoid-shaped), deltoid (triangular-shaped)

c. Origin and insertion

Example: Sternocleidomastoid

d. Number of divisions composing muscle

Examples: Quadriceps, biceps

e. Direction of muscle fibers

Examples: Transversus, rectus (straight)

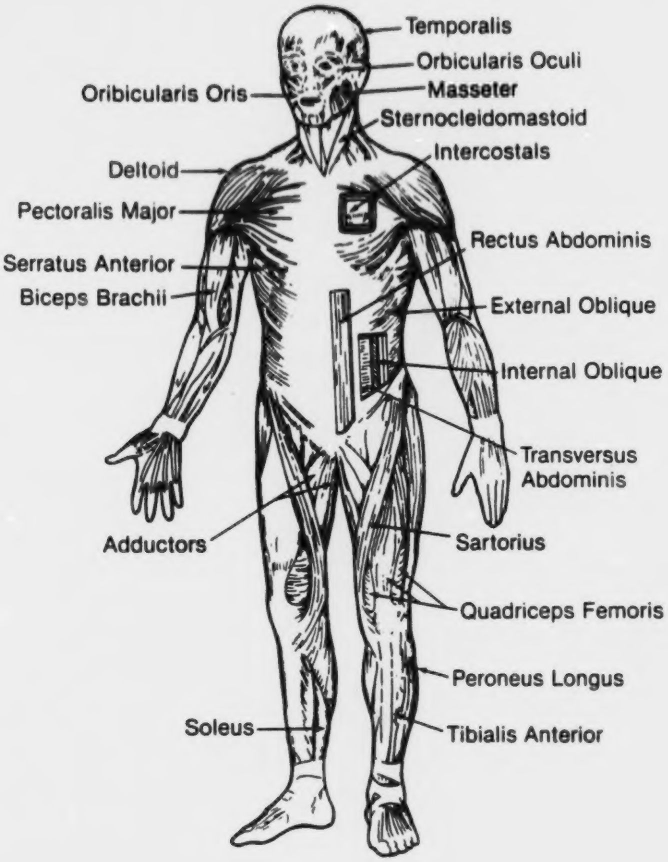
f. Location

Examples: Femoris, tibialis, abdominis

Information Sheet

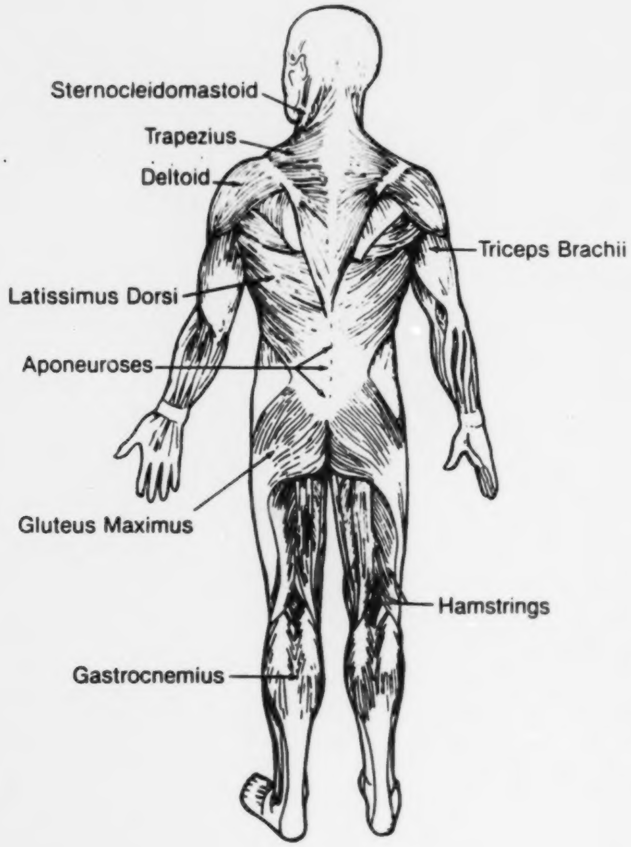
11. **Principal skeletal muscles and their locations** (Figures 3 and 4)

Figure 3—Principal muscles (anterior view)


Temporalis
Orbicularis Oculi
Oribicularis Oris
Masseter
Sternocleidomastoid
Intercostals
Deltoid
Pectoralis Major
Rectus Abdominis
Serratus Anterior
Biceps Brachii
External Oblique
Internal Oblique
Transversus Abdominis
Adductors
Sartorius
Quadriceps Femoris
Peroneus Longus
Soleus
Tibialis Anterior

Information Sheet

Figure 4—Principal muscles (posterior view)


Sternocleidomastoid
Trapezius
Deltoid
Triceps Brachii
Latissimus Dorsi
Aponeuroses
Gluteus Maximus
Hamstrings
Gastrocnemius

a. Muscles of the head

(1) Orbicularis oculi — Surrounds eyelid

(2) Orbicularis oris — Surrounds mouth

(3) Buccinator — Found in the fleshy part of the cheek

(4) Masseter — Found from the zygomatic arch to the mandible

Information Sheet

b. Muscles of the neck

  (1) Trapezius — Comes down from the neck and fans out like a pointed cape over the back of the shoulder

  (2) Sternocleidomastoid — Extends along each side of the neck from the sternum and clavicles to the mastoid process of the temporal bone

  (3) Platysma — Subcutaneous neck muscle which extends from the chin to the clavicles

c. Muscle of the shoulder — Deltoid — Muscular cap of each shoulder which is shaped like an upside-down triangle

d. Muscles of the upper arms

  (1) Biceps brachii — Located on the anterior side of the upper arm; has two heads

  (2) Triceps brachii — Located on the posterior side of the upper arm; has three heads

  (3) Brachialis — Located in the lower part of upper arm and upper forearm

e. Muscles of the chest

  (1) Pectoralis major — Located on either side of chest high up in breast region; forms anterior wall of axilla

  (2) Serratus anterior — Located below the axillae on the sides of the chest

  (3) External and internal intercostals — Located in the spaces between the ribs

f. Muscles of the back

  (1) Trapezius — Comes down from the neck and fans out like a pointed cape over the back of the shoulder

  (2) Latissimus dorsi — Originates in lower half of spine and covers lower half of thoracic region

Information Sheet

g. Muscles of the abdomen

(1) Lateral walls of abdomen

(a) External oblique — Located as the **outer** muscular layer which originates along the ribs and inserts at the os coxae and linea alba; is slanted

Note: The linea alba is a white line which extends from the xiphoid process to the symphysis pubis and is formed by fibers of aponeuroses of right and left abdominal muscles. During pregnancy, the linea alba becomes pigmented and is know as linea niger.

(b) Internal oblique — Located as the **middle** layer which originates at the os coxae and inserts along the ribs; runs the opposite direction of the external oblique

(c) Transversus abdominis — **Innermost** layer which runs transversely across the abdomen

(2) Front of abdomen is closed by rectus abdominis — A long narrow muscle which originates at pubis and ends at ribs and is completely enclosed by connective tissue from the three other muscles of the abdomen

Note: This is the muscle that is split vertically when a midline abdominal incision is made.

h. Primary muscle of respiration — Diaphragm — Dome-shaped muscle that separates the abdominal cavity from the thoracic cavity

i. Muscles of pelvic floor or perineum

Note: This pelvic floor or perineum has a muscular shape somewhat like a shallow dish.

(1) Levator ani — Located on pelvic floor

(2) Coccygeus — Located as posterior continuation of the levator ani

j. Muscles of the lower extremities

(1) Muscles of the buttocks (Gluteal group)

(a) Gluteus maximus — Relatively large muscle which forms the main part of the buttocks

(b) Gluteus medius — Located on lateral surface of ilium

(c) Gluteus minimus — Located on lateral surface of ilium to the greater trochanter of the femur

Information Sheet

(2) Muscles of the thigh

- (a) Sartorius — Long, narrow muscle which begins at iliac spine, winds downward and inward across entire thigh, and ends on upper medial surface of tibia
- (b) Quadriceps femoris — Four part muscle located in the anterior thigh
- (c) Adductors — Three muscles in group located on medial part of thigh
- (d) Hamstrings — Three muscles in group located on posterior of thigh

(3) Muscles of the lower leg

- (a) Gastrocnemius — Muscle in calf of the leg which ends near the heel in the Achilles tendon
- (b) Tibialis anterior — Located on the anterior aspect of the lower leg
- (c) Peroneus longus — Located on lateral side of lower leg
- (d) Soleus — Located along medial aspect of lower leg

12. **Principal skeletal muscles and their functions** (Figures 3 and 4)

a. Muscles of head

(1) Muscles for facial expression

- (a) Orbicularis oculi — Closes eyelids
- (b) Orbicularis oris — Draws lips together as in kissing
- (c) Buccinator — "Trumpeter's muscle;" used in blowing, whistling, and smiling

(2) Muscle of mastication (chewing) — Masseter — Closes jaw as in chewing

b. Muscles of the neck

(1) Trapezius — Moves shoulders by raising and throwing them back, assists in moving head to one side or the other, hyperextends head when occiput acts as insertion, and helps hold head erect

(2) Sternocleidomastoid — Rotates head from side-to-side, flexes upper vertebral column and head as in bowing the head, and helps hold head erect; also called "praying muscle"

(3) Platysma — Acts to wrinkle skin in neck and depresses mandible

Information Sheet

c. Muscle of the shoulder — Deltoid — Moves the upper arm at the shoulder joint (abducts, extends, and flexes)

Note: The deltoid is a common injection site for intramuscular (IM) injections.

d. Muscles of the upper arms

(1) Biceps brachii — Flexes the upper arm when the hand is supinated

(2) Triceps brachii — Extends the upper arm

(3) Brachialis — Flexes the upper arm when the hand is pronated

e. Muscles of the forearms — Flex and extend the forearms, wrists, and fingers

Note: There are many muscles in this area which coordinate these fine motor skills.

f. Muscles of the chest

(1) Pectoralis major — Flexes and adducts upper arm anteriorly across the chest

Note: This is excised during a radical mastectomy.

(2) Serratus anterior — Moves the scapula forward, as in pushing something

(3) External and internal intercostals — Assists in respirations by enlarging the thoracic cavity on inspiration

g. Muscles of the back

(1) Trapezius — Moves shoulders by raising and throwing them back, assists in moving head to one side or the other, hyperextends head when occiput acts as insertion, and helps hold head erect

(2) Latissimus dorsi — Brings down arms forcibly as in swimming

h. Muscles of the abdomen — Assist indirectly in respiration as they relax when the diaphragm contracts and vice versa; compress internal organs to aid in defecation, urination, and childbirth; and assist in bending trunk in various directions

Note: The abdominal muscles are arranged in layers with fibers running in different directions to make a strong abdominal wall.

Information Sheet

i. Primary muscle of respiration — Diaphragm — Main muscle used in breathing which contracts during inspiration and relaxes during expiration

j. Muscles of pelvic floor or perineum — Levator ani and coccygeus — Support pelvic organs and act on rectum to aid with defecation

k. Muscles of lower extremities

Note: These are the longest and strongest muscles of the body.

(1) Muscles of the buttocks

- (a) Gluteus maximus — Functions in maintaining an erect position, extends and rotates thigh, and is very important in walking and running
- (b) Gluteus medius — Abducts thigh, rotates thigh outward, and stabilizes pelvis in femur
- (c) Gluteus minimus — Abducts thigh, rotates thigh outward, and stabilizes pelvis in femur as the gluteus medius does; also extends the thigh

(2) Muscles of the thigh

- (a) Sartorius — Adducts and flexes leg; called "tailor's muscle" because it is used in crossing legs
- (b) Quadriceps femoris

  Note: The quadriceps femoris is the muscle that gets a charley horse, which is a muscle spasm with soreness and stiffness.

  1) Extends knee as in kicking football
  2) Includes four parts

     a) Rectus femoris
     b) Vastus lateralis
     c) Vastus medialis
     d) Vastus intermedius

- (c) Adductors

  1) Press thighs together, as in horseback riding
  2) Include three in a group

     a) Adductor brevis
     b) Adductor longus
     c) Adductor magnus

Information Sheet

- (d) Hamstrings
    - 1) Flex lower leg making angle at the knee joint smaller
    - 2) Include three in group
        - a) Biceps femoris
        - b) Semitendinosus
        - c) Semimembranosus

(3) Muscles of the lower leg

- (a) Gastrocnemius — Extends the foot, used to stand on tiptoes, and is called the "dancer's muscle"
- (b) Tibialis anterior — Flexes foot and inverts ankle (used to walk on heels)
- (c) Peroneus longus — Everts the ankle
- (d) Soleus — Inverts the ankle

(4) Muscles of the foot

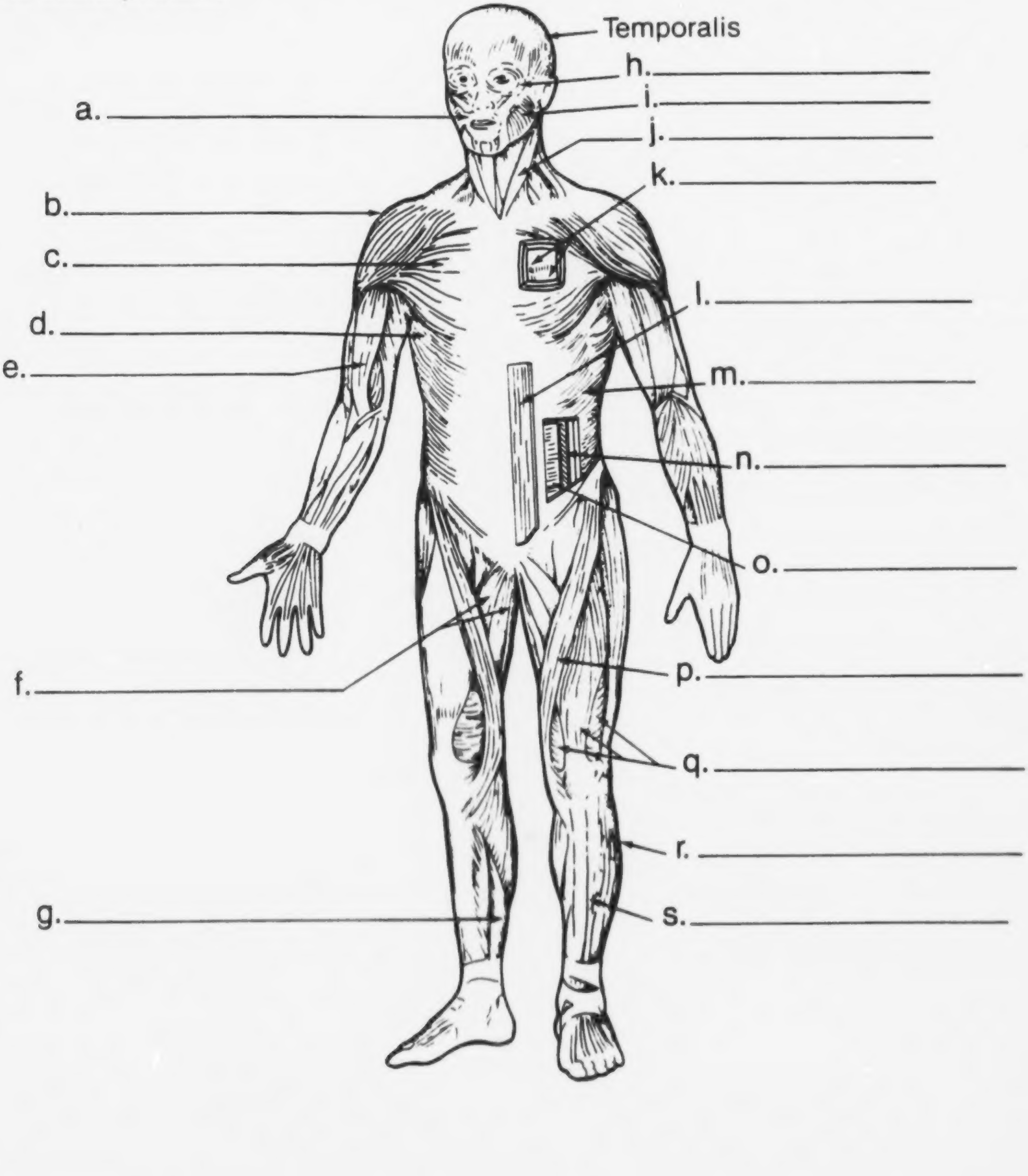
- (a) Flexor digitorum — Flexes toes
- (b) Extensor digitorum — Extends toes

Muscular System
Unit 5

Student Supplement 1—Identify the Principal Skeletal Muscles

Name ____

Directions: Identify the skeletal muscles on the following illustrations. Write your answers in the blanks provided.


Temporalis
h. ____________________
i. ____________________
j. ____________________
k. ____________________
a. ____________________
b. ____________________
c. ____________________
d. ____________________
e. ____________________
l. ____________________
m. ____________________
n. ____________________
o. ____________________
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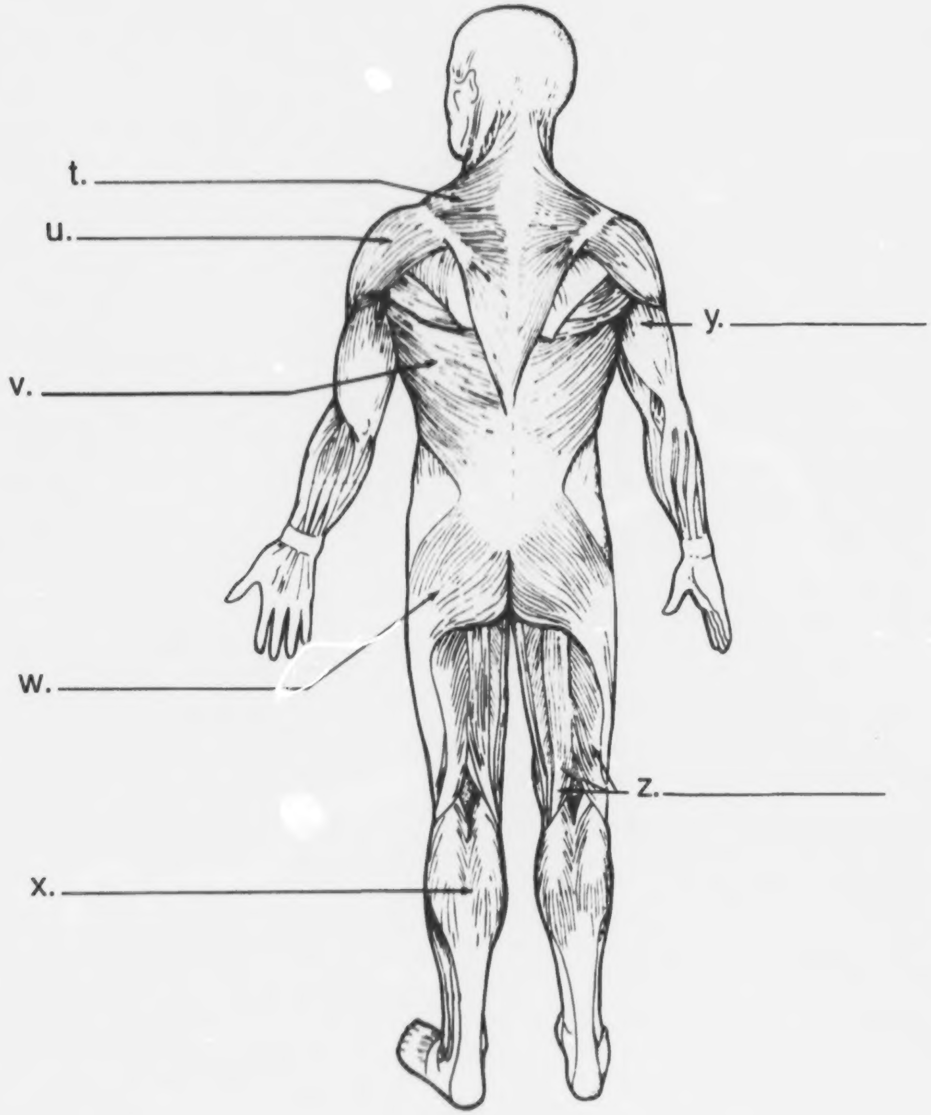
p. ____________________
q. ____________________
r. ____________________
g. ____________________
s. ____________________

Student Supplement 1



Muscular System
Unit 5

Student Supplement 2—Complete Statements Concerning the Muscular System

Name ____

Directions: Complete the following statements or questions by placing the correct letters in the blanks provided.

______ 1. The large tendon at the lower end of the gastrocnemius muscle, which is inserted into the ankle, is the strongest and thickest tendon in the body and is called

a. Brachial radialis
b. Gluteus maximus
c. Soleus
d. Achilles

______ 2. Muscles that bend a body part are known as

a. Extensors
b. Flexors
c. Prime movers
d. Antagonists

______ 3. Muscles that extend a body part are called

a. Extensors
b. Flexors
c. Prime movers
d. Antagonists

______ 4. The movement required in walking is the result of

a. The relaxation of smooth muscles
b. Energy produced by the cardiac muscle
c. The contraction and relaxation of the skeletal muscles
d. Food burned by the skeletal muscles

______ 5. In cold weather, the brain stimulates the skeletal muscles to produce more heat by causing us to

a. Shiver
b. Feel cold
c. Feel hungry
d. Put on more clothing

Student Supplement 2

_____ 6. Muscle cells get their energy to contract from the oxidation of

a. Simple sugars such as glucose
b. Digested food substances
c. Protein in the cells
d. Fat around the cells

_____ 7. The ability of a stretched muscle to return to its normal length is known as

a. Contractility
b. Elasticity
c. Extensibility
d. Irritability

_____ 8. The muscular structure which forms the floor of the pelvis is called the

a. Peritoneum
b. Parietal muscle
c. Mons pubis
d. Perineum

_____ 9. Muscles help the veins with the upward movement of blood when they

a. Atrophy
b. Contract
c. Hypertrophy
d. Stimulate the nerve endings

_____10. The large calf muscle is know as

a. Quadriceps femoris
b. Deltoid
c. Triceps
d. Gastrocnemius

_____11. The large dome-shaped muscle that separates the thoracic and abdominal cavities is called the

a. Peritoneal fold
b. Diaphragm
c. Intercostal muscle
d. Interthoracic muscle

_____12. When muscles have good tone, they are

a. Completely relaxed and flaccid
b. Always in a state of partial contraction
c. Smaller than normal
d. Permanently contracted

Student Supplement 2

______13. As one muscle contracts, the antagonist must

a. Also contract
b. Relax
c. Produce more energy
d. Flex

______14. Ligaments have the job of

a. Attaching muscles to bone
b. Attaching one bone to another bone
c. Contracting to allow movement
d. Supporting muscle tissue

______15. Bundles of fibers which are held together by connective tissue are

a. Cartilage
b. Ligaments
c. Bursae
d. Muscles

______16. Muscles are attached to bones by

a. Ligaments
b. Bursae
c. Tendons
d. Periosteum

______17. The type of muscle found in the deltoid is

a. Voluntary
b. Involuntary
c. Cardiac
d. Smooth

______18. Which muscle do you contract when you flex your arm?

a. Trapezius
b. Triceps
c. Pectoral
d. Biceps

______19. Which muscle do you relax when you flex your arm?

a. Trapezius
b. Triceps
c. Pectoral
d. Biceps

Student Supplement 2

______20. Moving a limb toward the midline of the body is referred to as

a. Flexion
b. Extension
c. Abduction
d. Adduction

______21. The muscle that abducts the upper arm at the shoulder joint is the

a. Deltoid
b. Pectoralis major
c. Triceps
d. Biceps

______22. The buccinator muscle

a. Aids in defecation
b. Keeps the trunk from falling backwards when standing
c. Is the dome-shaped muscle used for breathing
d. Is one of the largest muscles for facial expression

______23. The biceps brachii and triceps brachii are located in the

a. Lower leg
b. Lateral thigh
c. Chest
d. Upper arm

______24. The sternocleidomastoid is located in the

a. Thigh
b. Around the eye
c. Neck
d. Buttocks

______25. The external oblique and rectus abdominis are both found in the

a. Abdominal wall
b. Buttocks
c. Chest
d. Back of the heel

______26. The quadriceps femoris, vastus lateralis, and sartorius are all located in the

a. Back
b. Lower arm
c. Calf of leg
d. Thigh

Student Supplement 2

______27. The part of the muscle that is attached to the more movable bone is the

a. Insertion
b. Origin
c. Body
d. Belly

______28. When the hamstring muscles contract, they

a. Flex the lower leg, making the angle at the knee joint smaller
b. Extend the lower leg, making the angle at the knee joint larger
c. Flex the lower arm, making the angle at the elbow joint larger
d. Extend the lower arm, making the angle at the elbow joint smaller

______29. When a muscle shortens, it exerts pull. This characteristic is

a. Contractility
b. Tonus
c. Irritability
d. Elasticity

______30. Select the muscle part which does **NOT** belong with the other three.

a. Body or belly
b. Insertion
c. Origin
d. Tendon

______31. An example of a muscle attachment is

a. The Achilles tendon
b. The biceps
c. A ligament
d. A nerve

______32. All the following are functions of the muscles **EXCEPT**

a. Heat production
b. Production of red blood cells
c. Posture
d. Protection

______33. Muscles which cause a part to pivot on its axis are

a. Abductors
b. Pronators
c. Rotators
d. Adductors

Student Supplement 2

______34. A sac or cavity filled with fluid which prevents friction on moving parts is called a

a. Ganglion
b. Tendon
c. Ligament
d. Bursa

______35. The layer of connective tissue which covers muscle tissue is know as

a. Perimysium
b. Endomysium
c. Serous membrane
d. Epimysium

______36. The sternocleidomastoid muscle

a. Aids in hearing
b. Aids in swallowing
c. Raises the arm
d. Rotates head to side

______37. The muscle surgically incised during a radical mastectomy is the

a. Intercostals
b. Brachialis
c. Trapezius
d. Pectoralis major

______38. A straight incision splitting the muscle fibers vertically in the abdominal wall will separate the following muscle

a. Transversalis
b. External oblique
c. Aponeuroses
d. Rectus abdominis

______39. The muscle which enlarges the chest cavity during inspiration is the

a. Trapezius
b. Pectoralis minor
c. Pectoralis major
d. Diaphragm

Student Supplement 2

______40. The muscle that encircles the eyelid is the

a. Buccinator
b. Masseter
c. Orbicularis oris
d. Orbicularis oculi

______41. The **white** line that extends from the xiphoid process to the symphysis pubis is the

a. Aponeurosis
b. Articulation
c. Linea alba
d. Linea niger

______42. Which muscle moves the shoulder?

a. Deltoid
b. Pectoralis major
c. Sternocleidomastoid
d. Trapezius

______43. Muscles that reduce the size of an opening are

a. Tensors
b. Levators
c. Depressors
d. Sphincters

______44. Which muscle moves the upper arm?

a. Deltoid
b. Pectoralis minor
c. Triceps brachii
d. Tibialis anterior

Nervous System
Unit 6

Objective Sheet

Unit Objective

After completing this unit, the student should be able to distinguish between the divisions of the nervous system, identify parts of the brain, and complete charts concerning spinal and cranial nerves. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the nervous system with their correct definitions.
2. List functions of the nervous system.
3. Match the parts of a typical neuron with the correct functions.
4. Distinguish between types of neurons.
5. Select true statements concerning the transmission of nerve signals.
6. Arrange in order the components of a reflex arc.
7. Complete statements concerning characteristics of a nerve fiber.
8. Match parts of a nerve fiber with the correct descriptions.
9. Arrange in order the mechanism of regeneration of peripheral nerves.
10. Distinguish between the two main divisions of the nervous system.
11. Select constituents found in the spinal canal.
12. Complete statements concerning characteristics of the spinal cord.
13. List components of cerebrospinal fluid.
14. State the purpose of cerebrospinal fluid.
15. Match the layers of the meninges with the correct descriptions.

Objective Sheet

16. Identify the parts of the brain.
17. Identify the lobes of the cerebral hemisphere.
18. Match the parts of the brain with the correct functions.
19. Identify the functional areas of the brain.
20. Match the fissures of the brain with the correct descriptions.
21. Complete statements concerning characteristics of the ventricles of the brain.
22. Complete statements concerning the blood supply to the brain.
23. Complete a chart of the names and number of pairs of spinal nerves.
24. List plexuses of the central nervous system.
25. Complete a chart of the names, numbers, and specific functions of cranial nerves.
26. Distinguish between the subdivisions of the autonomic nervous system.

Nervous System
Unit 6

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Typical Neuron (Objective 3)
   TM 2—Sensory, Connecting, and Motor Neurons (Objective 4)
   TM 3—Synapse (Objective 5)
   TM 4—Reflex Arc (Objective 6)
   TM 5—Regeneration of a Nerve Fiber (Objective 9)
   TM 6—Sagittal Section of the Brain (Objective 16)
   TM 7—Lobes of the Cerebral Hemisphere (Objective 17)
   TM 8—Functional Areas of the Brain (Objective 19)
   TM 9—Ventricles of the Brain (Objective 21)
   TM 10—Plexuses of the Central Nervous System (Objective 24)
   TM 11—Cranial Nerves (Objective 25)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

Suggested Activities

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Use simulated models to demonstrate the anatomy discussed in this unit.

2. Discuss the ways the body protects the central nervous system.

    a. Cranial bones and vertebrae

    b. Meninges

    c. Cerebrospinal fluid

3. Show available films dealing with the nervous system.

4. Discuss why the medulla oblongata is considered the most vital part of the brain.

5. After discussing the reflex arc in Objective 6, have students test their reflexes.

Suggested Activities

6. Help students memorize the cranial nerves by using the following mnemonic (memory) device:

   On Old Olympus Towering Top, A Fin And German Viewed Some Hop

7. Discuss major diseases or conditions affecting the nervous system such as poliomyelitis, meningitis, and hydrocephalus.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.
2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm C. Brown Company Publishers, 1990.
3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.
4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Supplemental Resources

1. Videotapes

   a. *The Vital Connection*, part of *The Body Human* Series available from:

      Medcom/Trainex
      Box 3225
      Garden Grove, CA 92641
      800-877-1443

   b. *Nerves at Work*

   c. *Decision*

   d. *Our Talented Brain*

      b-d are part of *The Living Body* Servies available from:

      Films for the Humanities and Sciences
      P.O. Box 2053
      Princeton, NJ 08543-2053
      800-257-5126 or 609-452-1128

Suggested Activities

2. Software programs

   a. *Neuromuscular Concepts*, 3 disks, for Apple II's. Available from:

      Queue, Inc.
      338 Commerce Drive
      Fairfield, CT 06430
      800-232-2224

   b. *Muscle, the Spinal Cord, and Peripheral Nervous System* (module 7)

   c. *The Central Nervous System* (Module 8)

      b-c are part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

      Health Sciences Consortium
      201 Silver Cedar Court
      Chapel Hill, NC 27514-1517
      919-942-8731

3. Audiotape—*Respiratory and Nervous Systems*, part of the *Medical Terminology Made Easy* Series of audiotapes available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

4. Anatomy charts and models on the brain and nervous system are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
      P.O. Box 21207
      Waco, TX 76702-1207
      800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
      3823 Leavenworth Street
      Omaha, NB 68105
      800-228-7117

Nervous System
Unit 6

Answers to Student Supplements

Student Supplement 1

a. Dendrites
b. Cell body or cyton
c. Axon

Student Supplement 2

a. Midbrain
b. Pons
c. Cerebellum
d. Medulla oblongata
e. Hindbrain
f. Forebrain
g. Cerebrum
h. Thalamus
i. Hypothalamus

Student Supplement 3

a. Frontal
b. Temporal
c. Parietal
d. Occipital
e. Central

Student Supplement 4

a. 6
b. 3
c. 4
d. 5
e. 2
f. 1
g. 7

Answers to Student Supplements

Student Supplement 5

a. Spinal
b. Cervical
c. 12
d. 5
e. Sacral
f. Coccygeal
g. 31
h. Cranial
i. Olfactory
j. Sense of sight
k. Oculomotor
l. Trochlear
m. Trigeminal
n. Controls lateral eye movement
o. Facial
p. Auditory
q. Sense of hearing and balance
r. Glossopharyngeal
s. Taste, swallowing
t. Vagus
u. Controls muscles of neck and upper back
v. Controls tongue muscles

Student Supplement 6

1. a
2. c
3. b
4. b
5. d
6. b
7. c
8. c
9. c
10. c
11. c
12. b
13. d
14. c
15. b
16. b
17. d
18. d
19. a
20. b
21. a
22. b
23. b
24. b
25. a
26. c
27. a
28. a
29. b
30. c
31. b
32. c
33. c
34. d

Nervous System
Unit 6

Answers to Written Test

1. a. 9
   b. 10
   c. 2
   d. 3
   e. 1
   f. 7
   g. 6
   h. 4
   i. 8
   j. 12
   k. 5
   l. 11
   m. 22
   n. 21
   o. 17
   p. 26
   q. 18
   r. 19
   s. 16
   t. 25
   u. 14
   v. 20
   w. 13
   x. 23
   y. 24
   z. 15

2. Any two of the following:

   a. To receive internal and external stimuli through sensory organs
   b. To transmit messages to and from the brain which interprets messages, stores information (if needed), and coordinates response (if needed)
   c. To respond to internal and external stimuli through motor organs

3. a. 3
   b. 2
   c. 1

4. a. M
   b. C
   c. S
   d. M
   e. M
   f. S
   g. C
   h. M
   i. C
   j. S

5. a, b, c

6. a. 3
   b. 4
   c. 2
   d. 1
   e. 5

7. a. Conduction
   b. Major
   c. Myelinated

Answers to Written Test

8. a. 2
   b. 1
   c. 3

9. a. 3
   b. 1
   c. 2

10. a, c, d

11. a, b, c, f, g

12. a. 18
    b. Vertebrae
    c. Spinal
    d. First or second
    e. Fourth and fifth
    f. Gray, white

13. Any two of the following:

    a. Water
    b. Glucose
    c. Sodium chloride
    d. Protein
    c. Some waste products such as urea

14. To circulate around the brain and spinal cord maintaining an even pressure and acting as a cushion or shock absorber

15. a. 2
    b. 3
    c. 1

16.

a.	1	f.	2
b.	8	g.	5
c.	4	h.	3
d.	6	i.	9
e.	7		

17. a. Temporal
    b. Frontal
    c. Parietal
    d. Occipital

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Answers to Written Test

18. a. 5
b. 8
c. 2
d. 10
e. 1
f. 9
g. 3
h. 6
i. 7

19. a. 4
b. 5
c. 3
d. 6
e. 2
f. 1
g. 7

20. a. 2
b. 3
c. 1

21. a. Four
b. Cerebrospinal
c. Cerebral
d. Inferior
e. Occipital
f. Interventricular foramen
g. Cerebral aqueduct of Sylvius

22. a. Willis
b. Circular
c. 15
d. Oxygen

23. a. Cervical
b. 5
c. Sacral
d. 1

24. Any three of the following:

a. Cervical
b. Brachial
c. Lumbar
d. Sacral
e. Coccygeal

25. a. Olfactory
b. Optic
c. Trigeminal
d. Abducens
e. Auditory
f. Taste, swallowing
g. Vagus

26. b, c, d, f

Nervous System
Unit 6

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

Note: Terms on this page match the definitions on this page.

______a. Study of the nervous system

______b. Basic nerve cell

______c. Part of the neuron that acts as a sending and receiving center, carries on metabolism, and stores energy

______d. Part of the neuron that carries impulses to the cell body

______e. Part of the neuron that conducts impulses away from the cell body; each cell has one

______f. Threadlike projections of cytoplasm from the cell body of a neuron; axons and dendrites

______g. Bundle of nerve fibers, blood vessels, and connective tissue outside the central nervous system

______h. Mass of nerve tissue, principally nerve cell bodies, outside the central nervous system

______i. Supporting structure for nerve tissue consisting of blood vessels, connective tissue, and specialized cells found only in the brain and spinal cord

______j. Junction of an axon and one or more dendrites which transmits nerve impulses in one direction only

______k. Ending of a nerve at a muscle

______l. A network of nerves

1. Axon
2. Cell body
3. Dendrite
4. Ganglion
5. Myoneural junction
6. Nerve
7. Nerve fibers
8. Neuroglia
9. Neurology
10. Neuron
11. Plexus
12. Synapse

Written Test

Note: Terms on this page match the definitions on this page.

______m. Noncellular, fatty covering of a nerve fiber

______n. Covered with myelin

______o. Nerve tissue of a grayish color consisting primarily of nonmyelinated nerve fibers; contains large numbers of cell bodies of neurons

______p. Nerve tissue consisting of myelinated nerve fibers

______q. Either half of the cerebrum or cerebellum

______r. A fairly well-defined part of an organ such as the brain separated by boundaries

______s. A deep groove or furrow in an organ such as the brain

______t. A slight groove, furrow, or depression in an organ, especially of the brain

______u. Watery fluid protecting the brain and spinal cord

______v. The tough, 3-layered membrane protecting the spinal cord and the brain

______w. Outer layer of gray matter of the cerebrum

______x. Repair, regrowth, or restoration of a part

______y. Any agent or influence that produces a response or increase in activity in living protoplasm

______z. Nerve endings that carry out actions

13. Cerebral cortex
14. Cerebrospinal fluid
15. Effectors
16. Fissure
17. Gray matter
18. Hemisphere
19. Lobe
20. Meninges
21. Myelinated
22. Myelin sheath
23. Regeneration
24. Stimulus
25. Sulcus
26. White matter

Written Test

2. List two functions of the nervous system.

   a. ______________________________

   b. ______________________________

3. Match the parts of a typical neuron on the right with the correct functions.

   ______a. Acts as a sending and receiving center; carries on metabolism; stores energy

   ______b. Carry impulses *to* the cell body; a neuron may have one or more

   ______c. Conducts impulses *away* from the cell body; a neuron NEVER has more than one

   1. Axon
   2. Dendrites
   3. Cell body

4. Distinguish between types of neurons by placing the following letters next to the correct descriptions: "S" for sensory, "C" for connecting, and "M" for motor neurons.

   ______a. Also called efferent

   ______b. Also called central or internuncial

   ______c. Also called afferent or receptor

   ______d. Located in muscles or glands

   ______e. *Transmit* messages from the central nervous system to all parts of the body

   ______f. *Receive* messages from all parts of the body and transmit them to the central nervous system

   ______g. Conduct messages or impulses from sensory to motor neurons

   ______h. Controlled by frontal lobe of brain

   ______i. Found only in the central nervous system

   ______j. Controlled by the thalamus

Written Test

5. Select true statements concerning the transmission of nerve signals by placing an "X" in the appropriate blanks.

______a. When a neuron receives a signal, it sends an impulse on to the next neuron across the synapse between axon and dendrite.

______b. Two or more neurons arranged in a chain function to conduct impulses from one place to another.

______c. Impulses pass only in one direction.

______d. When a nerve impulse is blocked, the blocking usually takes place at a dendrite.

6. Arrange in order the following components of a reflex arc by placing the correct sequence numbers in the appropriate blanks.

______a. Connecting neuron

______b. Efferent neuron

______c. Afferent neuron

______d. Affector (receptor)

______e. Effector

7. Complete the following statements concerning characteristics of a nerve fiber by circling the correct answers.

a. Is an elongated process of a neuron, usually the axon, concerned primarily with the (blockage, conduction) of impulses

b. Nerve fibers form the (major, minor) portion of the white matter of the brain and spinal cord and all nerves.

c. Most nerve fibers in peripheral nerves are (nonmyelinated, myelinated).

8. Match parts of a nerve fiber on the right with the correct descriptions.

______a. Central core of jelly-like material

______b. Fatty covering which provides insulation and speeds impulse conduction

______c. Thin membrane with nuclei called Schwann cells completely covering the nerve fiber; regenerates nerve fibers

1. Myelin sheath
2. Axis cylinder
3. Neurilemma

Written Test

9. Arrange in order the mechanism of regeneration of peripheral nerves by placing the correct sequence numbers in the appropriate blanks.

_____a. Remaining stump of the axon attached to the cell body is able to grow in the repaired tube.

_____b. Part of the fiber separated from the cell body disintegrates.

_____c. Neurilemma starts to regenerate at the site of injury.

10. Distinguish between the two main divisions of the nervous system by placing an "X" next to the components of the peripheral nervous system.

_____a. Autonomic nerves (ganglia and fibers)

_____b. Brain

_____c. Spinal nerves

_____d. Cranial nerves

_____e. Spinal cord

11. Select constituents found in the spinal canal by placing an "X" next to the correct constituents.

_____a. Spinal cord

_____b. Blood vessels

_____c. Cerebrospinal fluid

_____d. Muscle tissue

_____e. Cutaneous membrane

_____f. Adipose tissue

_____g. Meninges

Written Test

12. Complete the following statements concerning characteristics of the spinal cord by circling the correct answers.

    a. Is a small cord about (18, 30) inches long in the adult

    b. Lies within the spinal canal surrounded by the (vertebrae, ribs)

    c. (Cranial, Spinal) nerves emerge from the cord by two short roots, the dorsal root and the ventral root.

    d. In the embryo, the spinal cord occupies the entire spinal column extending down into the tail portion of the vertebral column. However, bone tissue grows more rapidly than nerve tissue so by adulthood the cord only reaches to the level of the (first or second, sixth or seventh) lumbar vertebra.

    e. Spinal anesthetics are given between third and fourth or (first and second, fourth and fifth) lumbar vertebrae.

    f. Cross section of the spinal cord reveals an inner H-shaped area of (white, gray) matter surrounded by an outer region of (white, gray) matter.

13. List two components of cerebrospinal fluid.

    a. ______________________________

    b. ______________________________

14. State the purpose of cerebrospinal fluid.

    ____

    ____

15. Match the layers of the meninges on the right with the correct descriptions.

_____a.	Outer layer; provides protection	1. Pia mater
_____b.	Middle layer; resembles a cobweb with cerebrospinal fluid filling the subarachnoid space under it	2. Dura mater
		3. Arachnoid
_____c.	Inner layer; is a thin vascular layer containing blood vessels which bring oxygen and carry away waste products	

Written Test

16. Identify the parts of the brain by matching the parts in the illustration with the correct names below.

_______a. Hindbrain

_______b. Midbrain

_______c. Forebrain

_______d. Thalamus

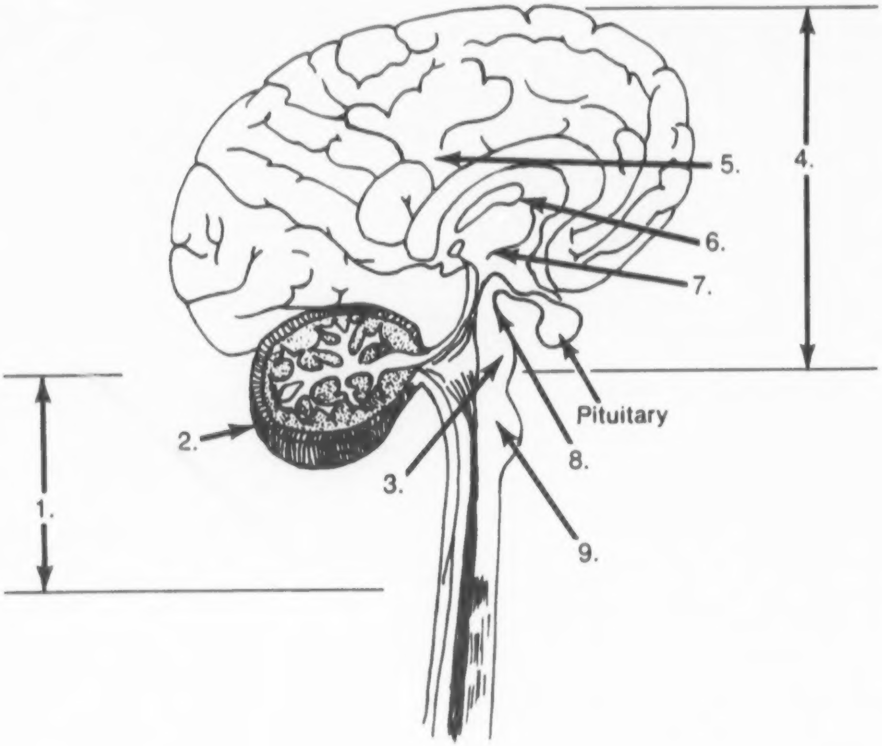
_______e. Hypothalamus

_______f. Cerebellum

_______g. Cerebrum

_______h. Pons

_______i. Medulla oblongata



Written Test

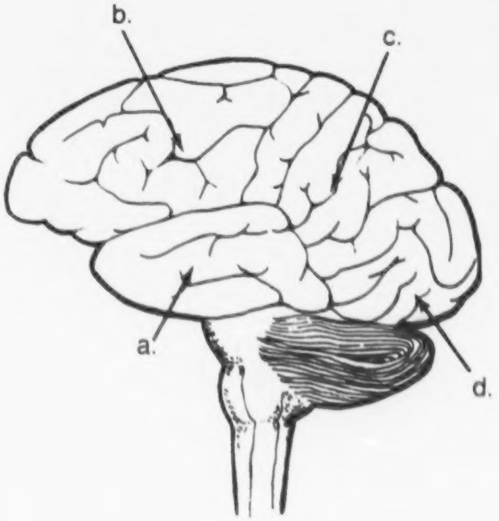
17. Identify the lobes of the cerebral hemisphere, and place your answers in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

d. ______________________



18. Match the parts of the brain on the right with the correct functions.

______a. Controls voluntary muscles and judgement

______b. Controls sensory functions such as pain, touch, and temperature interpretation

______c. Controls hearing, smell, and taste

______d. Controls vision

______e. Serves as relay center and monitors sensory stimuli

______f. Controls body temperature, water balance, sleep, appetite, some emotions such as fear and pleasure, and both divisions of the autonomic nervous system

______g. Serves as reflex center

1. Thalamus
2. Temporal lobe
3. Midbrain
4. Cerebellum
5. Frontal lobe
6. Pons
7. Medulla oblongata
8. Parietal lobe
9. Hypothalamus
10. Occipital lobe

______h. Relays impulses between the cerebrum and cerebellum, and the cerebrum and medulla oblongata

______i. Controls *vital* functions such as breathing, heart rate, blood pressure, swallowing, and coughing

19. Identify the functional areas of the brain by matching the parts in the illustration with the correct names below.

______a. Motor area

______b. Sensory area

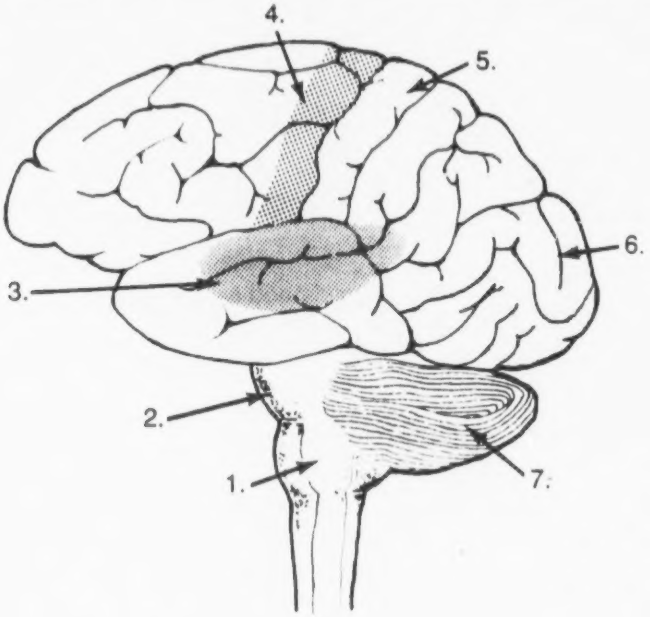
______c. Auditory area

______d. Visual area

______e. Cranial nerves V-VIII area

______f. Cranial nerves IX-XII area

______g. Balance, equilibrium, coordination, and muscle tone area



Written Test

20. Match the fissures of the brain on the right with the correct descriptions.

______a. The deep fissure between the cerebral hemispheres

______b. At a right angle to the longitudinal fissure

______c. Separates temporal lobe from rest of cerebral hemisphere

1. Lateral fissure (Fissure of Sylvius)
2. Longitudinal fissure
3. Central fissure (Fissure of Rolando)

21. Complete the following statements concerning characteristics of the ventricles of the brain by circling the correct answers.

    a. Are (four, five) cavities in the brain

    b. Are filled with (lymphatic, cerebrospinal) fluid

    c. The lateral ventricles are located inside the (cerebellar, cerebral) hemispheres.

    d. Each lateral ventricle possesses a posterior, anterior, and (superior, inferior) horn.

    e. The posterior horn extends into the (temporal, occipital) lobe.

    f. Each lateral ventricle communicates with the third ventricle by way of the (foramen of Magendie, interventricular foramen).

    g. The (cerebral aqueduct of Sylvius, interventricular foramen) connects the third ventricle with the fourth ventricle.

22. Complete the following statements concerning the blood supply to the brain by circling the correct answers.

    a. Four arteries, two internal carotids and two vertebrals, unite to form the Circle of (Willis, Vater) at the base of the brain.

    b. (Longitudinal, Circular) arrangement of the arteries equalizes the circulation of blood and provides an alternate passageway for blood in case of blockage of one of the arteries.

    c. Approximately (15, 30) percent of the total output of the heart is needed by the brain for normal function.

    d. Numerous centers of function in the brain required an adequate supply of (carbon dioxide, oxygen) at all times.

Written Test

23. Complete the following chart of the names and numbers of pairs of spinal nerves.

NAME	NUMBER OF PAIRS
a. ______	8
Thoracic	12
Lumbar	**b.** ______
c. ______	5
Coccygeal	**d.** ______
	31 pairs total

24. List three plexuses of the central nervous system.

a. ______

b. ______

c. ______

25. Complete the following chart of the names, numbers, and specific functions of cranial nerves.

NAME	NUMBER	FUNCTION
a. ______	I	Sense of smell
b. ______	II	Sense of sight
Oculomotor	III	Controls part of the eyeball muscles
Trochlear	IV	Controls one eyeball muscle
c. ______	V	Three branches supply cornea and conjunctiva, upper portion of face, ear, lower lip, teeth, and gums, and muscles for chewing
d. ______	VI	Controls lateral eye movement
Facial	VII	Supplies facial muscles, middle ear, and taste
E. ______	VIII	Sense of hearing and balance

Written Test

NAME	NUMBER	FUNCTION
Glossopharyngeal	IX	f. ____________________
g. ____________________	X	Swallowing, hunger, speech muscles, breathing, heart rate, peristalsis, and control of glands in stomach and pancreas
Spinal accessory	XI	Controls muscles of neck and upper back
Hypoglossal	XII	Controls tongue muscles

26. Distinguish between the subdivisions of the autonomic nervous system by placing an "X" next to the characteristics of the sympathetic or thoracolumbar division.

______a. Usually acts as a balance for the sympathetic division

______b. Includes centers which lie laterally to the anterior surface of the spinal column from the cervical, thoracic, and lumbar regions of the spinal cord and preganglionic fibers arising from these centers

______c. Includes great plexuses that are stimulated by impulses from the sympathetic ganglia

______d. Acts as an accelerator which increases activity of organs

______e. Functions while body is at rest and under no stress. All organs and systems function at normal rate.

______f. Functions during periods of stress, strenuous exercise, fatigue, and anger

______g. Fibers arise from midbrain or medulla and from sacral region of the cord out to the ganglia which lie on or near the viscera, blood vessels, and glands.

*Permission to duplicate this test is granted.

Nervous System
Unit 6

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

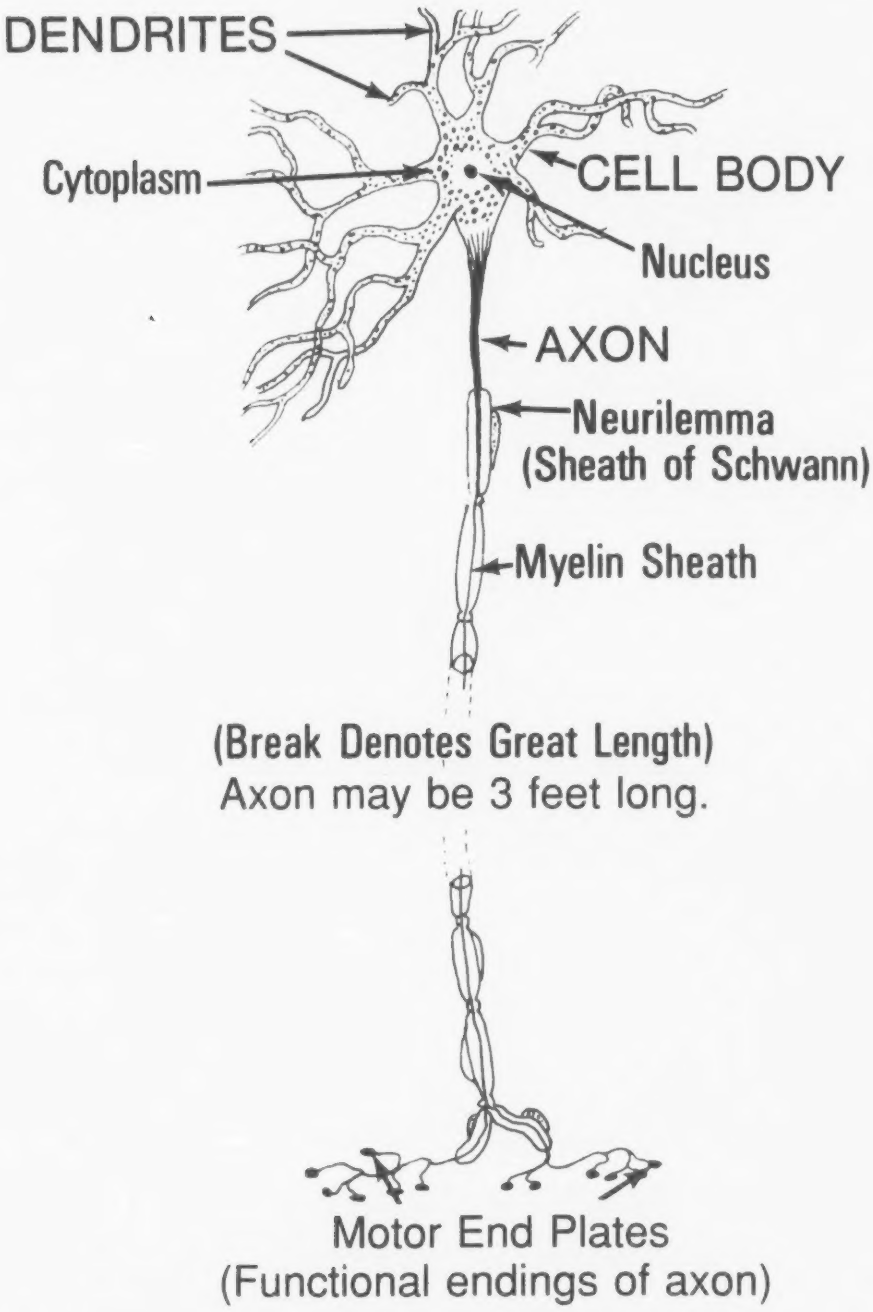
____

Teacher Signature ______________________________ Date __________

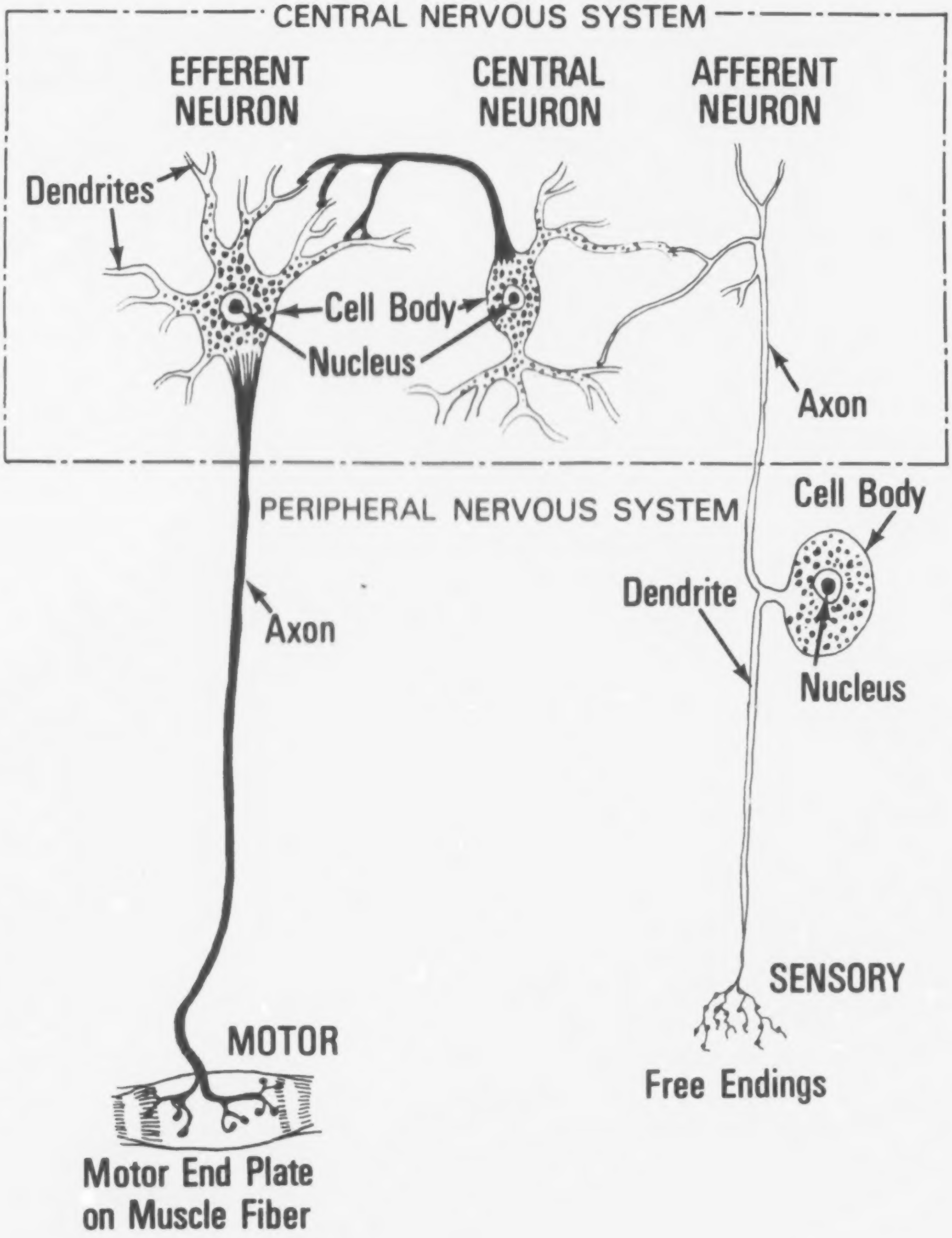
Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.

Typical Neuron

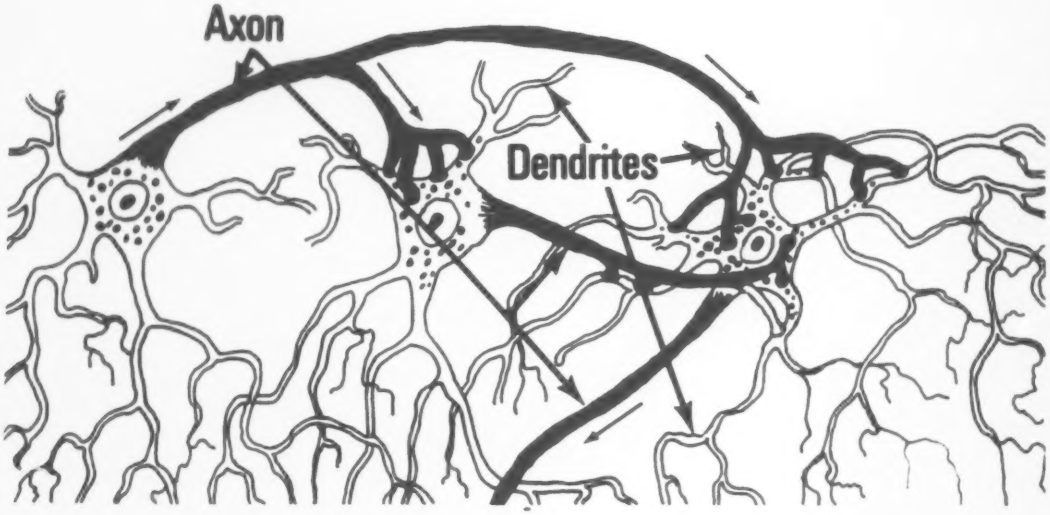

DENDRITES
Cytoplasm
CELL BODY
Nucleus
AXON
Neurilemma
(Sheath of Schwann)
Myelin Sheath
(Break Denotes Great Length)
Axon may be 3 feet long.
Motor End Plates
(Functional endings of axon)

Sensory, Connecting, and Motor Neurons

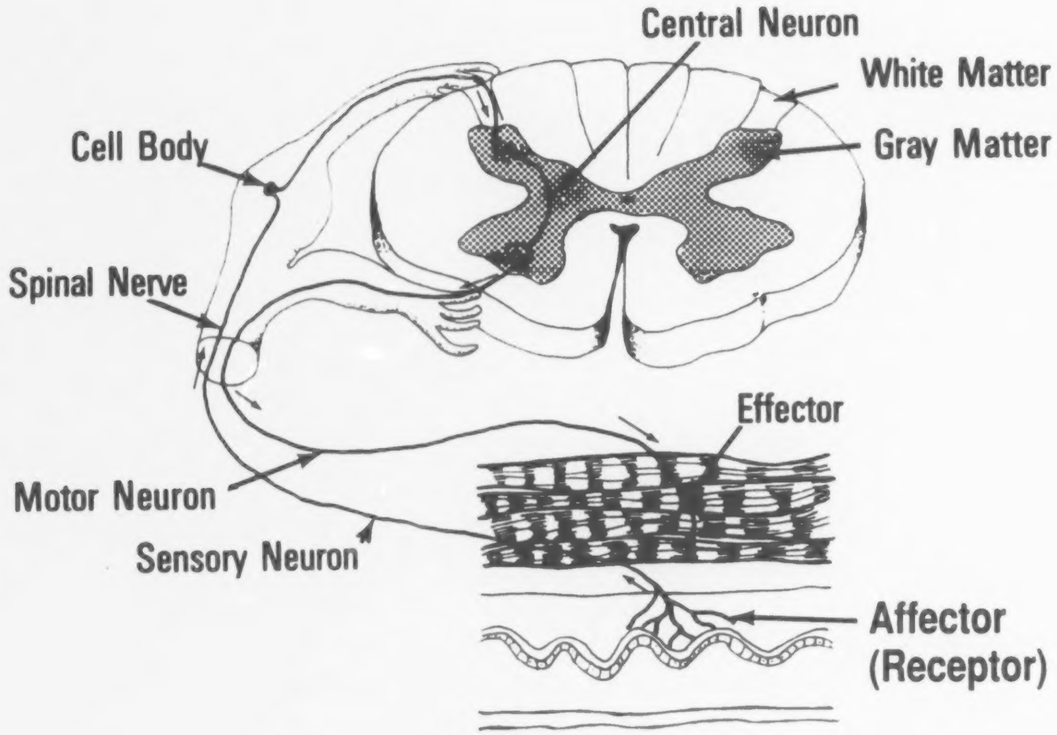

CENTRAL NERVOUS SYSTEM
EFFERENT NEURON
CENTRAL NEURON
AFFERENT NEURON
Dendrites
Cell Body
Nucleus
Axon
PERIPHERAL NERVOUS SYSTEM
Cell Body
Dendrite
Nucleus
Axon
SENSORY
Free Endings
MOTOR
Motor End Plate on Muscle Fiber

Synapse

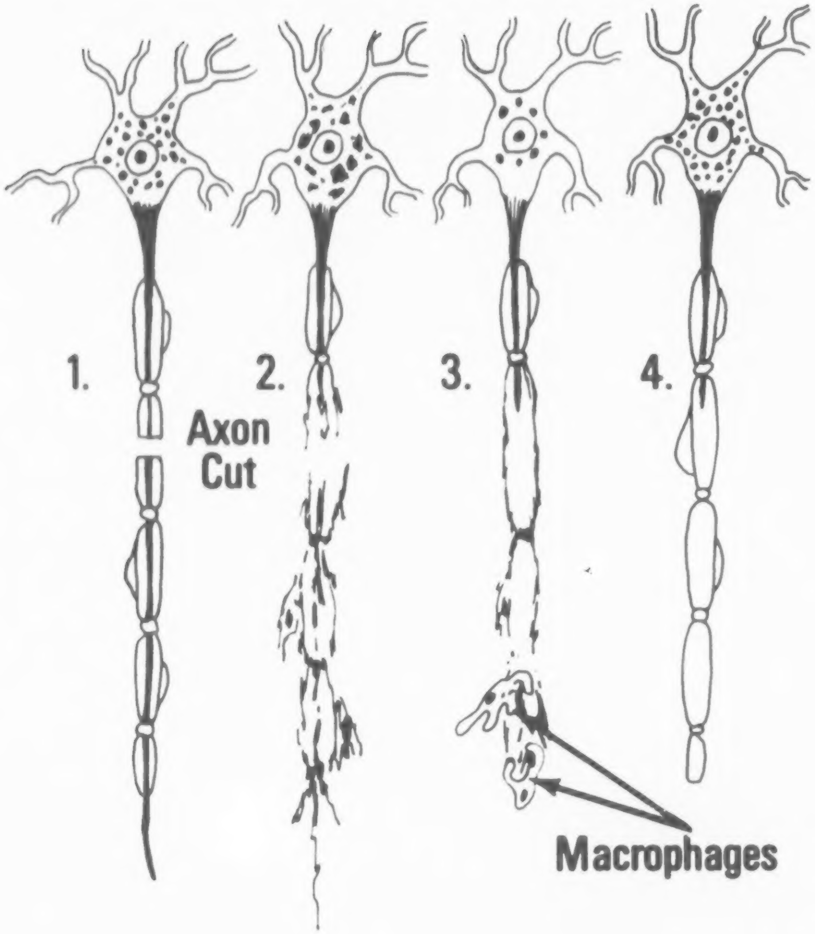
SYNAPSE: Ends of Axons Contact Dendrites or Cell Bodies of Other Cells for Transmission of Impulses



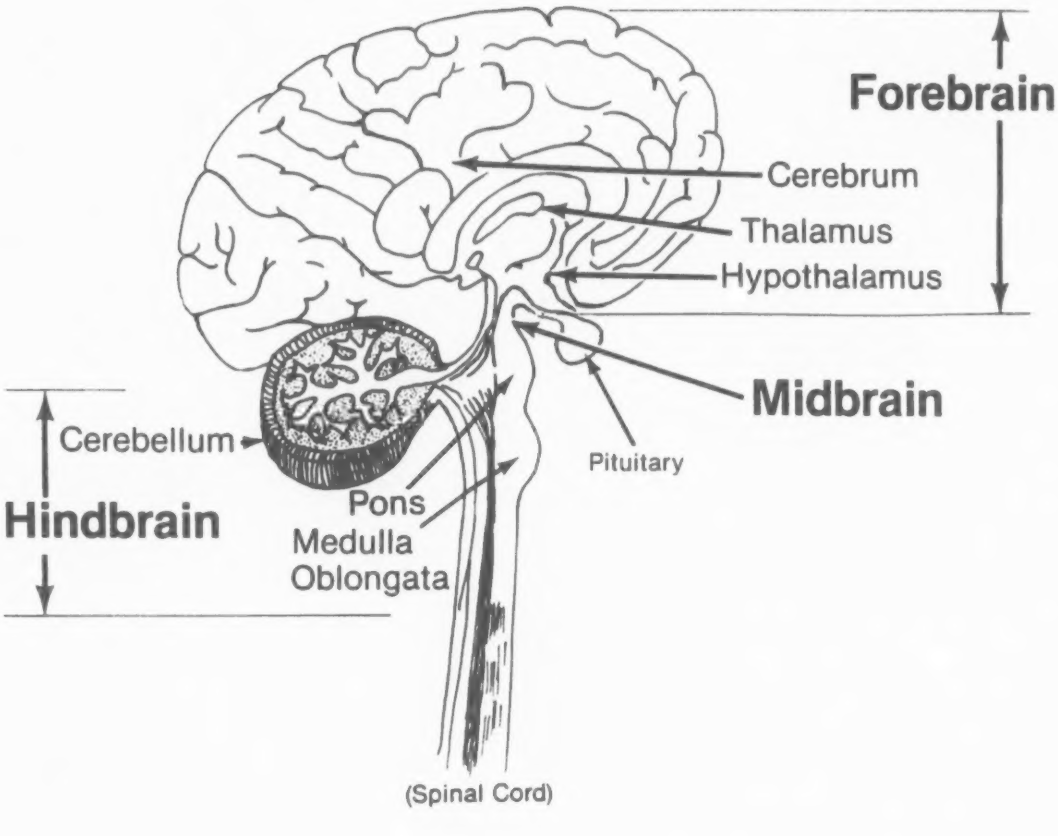
Reflex Arc


Central Neuron
White Matter
Gray Matter
Cell Body
Spinal Nerve
Effector
Motor Neuron
Sensory Neuron
Affector
(Receptor)

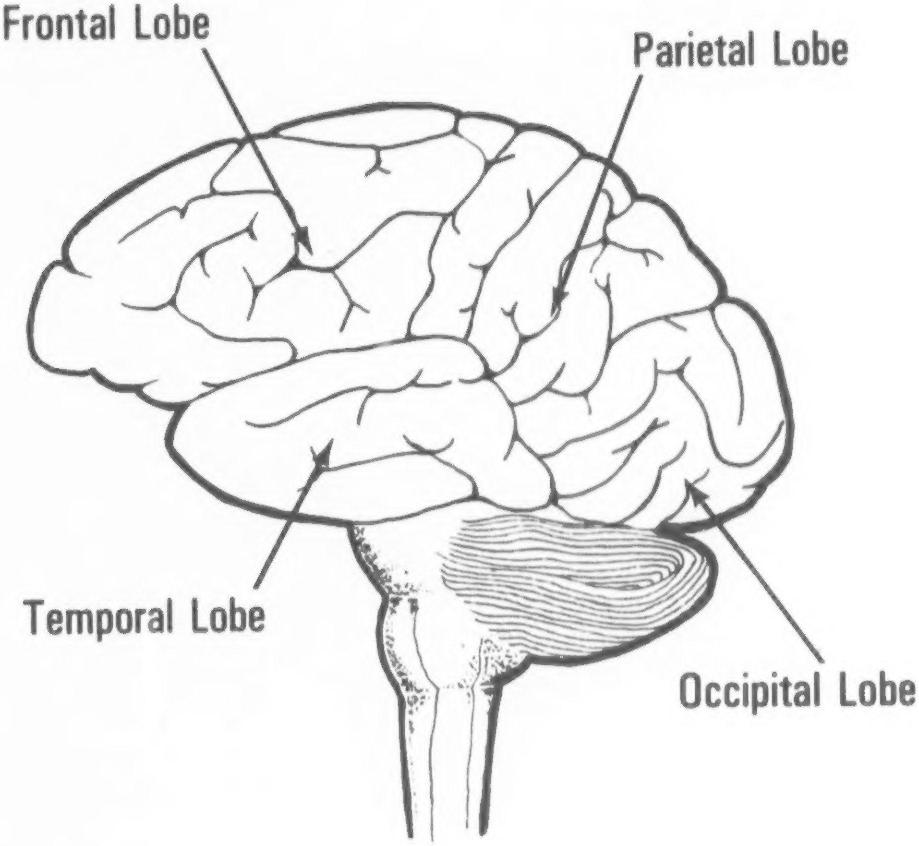
Regeneration of a Nerve Fiber


1.
Axon
Cut
2.
3.
4.
Macrophages

Sagittal Section of the Brain

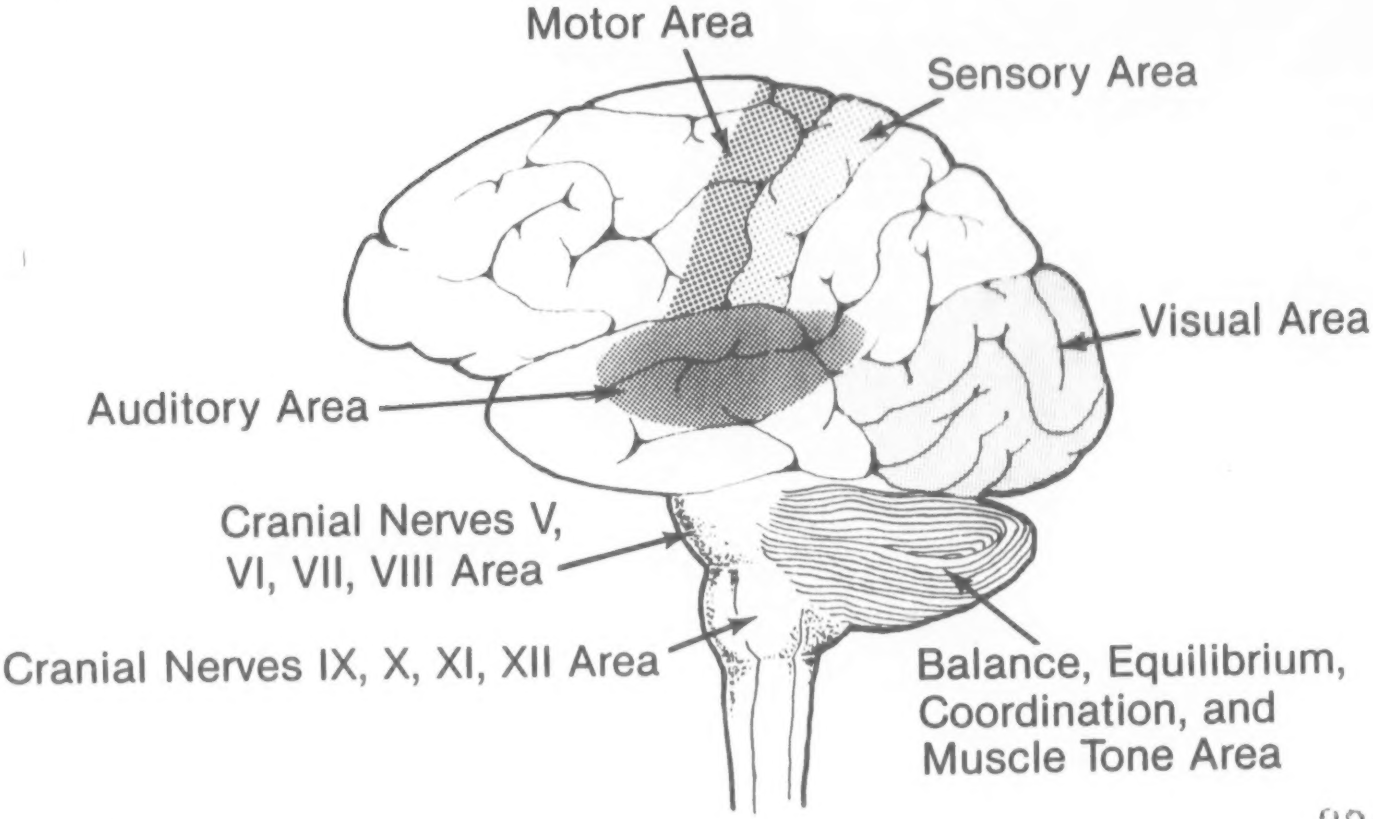

Forebrain
Cerebrum
Thalamus
Hypothalamus
Midbrain
Pituitary
Cerebellum
Hindbrain
Pons
Medulla
Oblongata
(Spinal Cord)

Lobes of the Cerebral Hemisphere

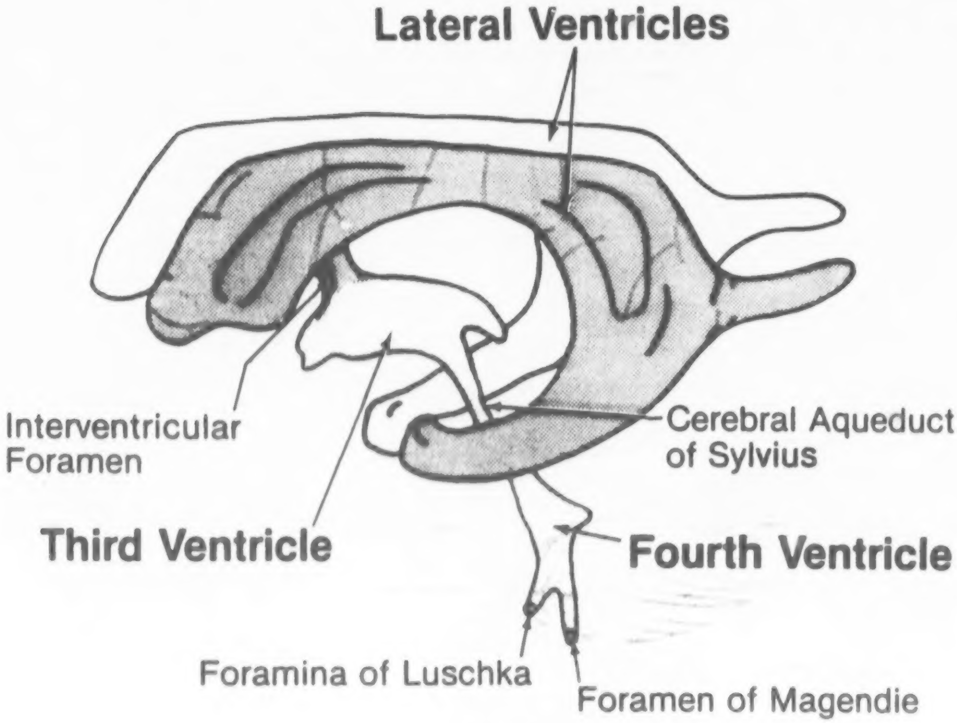

Frontal Lobe
Parietal Lobe
Temporal Lobe
Occipital Lobe

(NOTE: The central lobe is not shown in this illustration.)

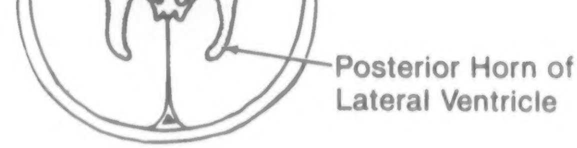
Functional Areas of the Brain


Motor Area
Sensory Area
Visual Area
Auditory Area
Cranial Nerves V, VI, VII, VIII Area
Cranial Nerves IX, X, XI, XII Area
Balance, Equilibrium, Coordination, and Muscle Tone Area

Ventricles of the Brain

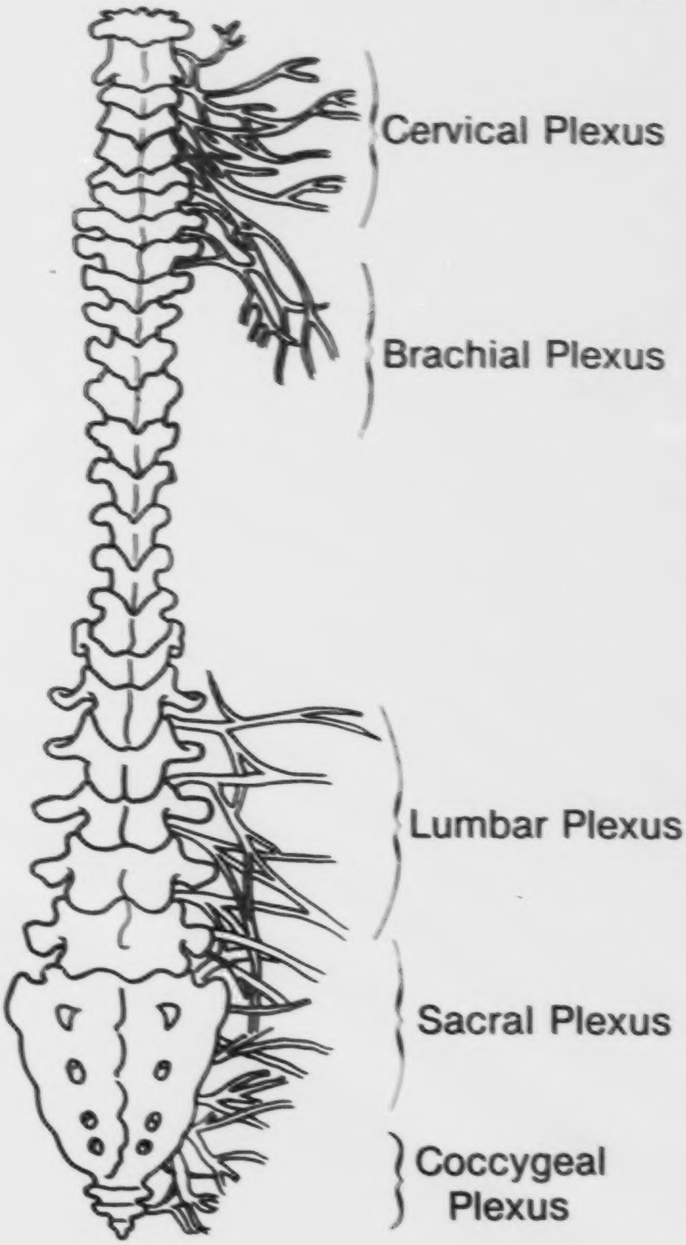

Lateral Ventricles
Interventricular Foramen
Cerebral Aqueduct of Sylvius
Third Ventricle
Fourth Ventricle
Foramina of Luschka
Foramen of Magendie

Lateral View

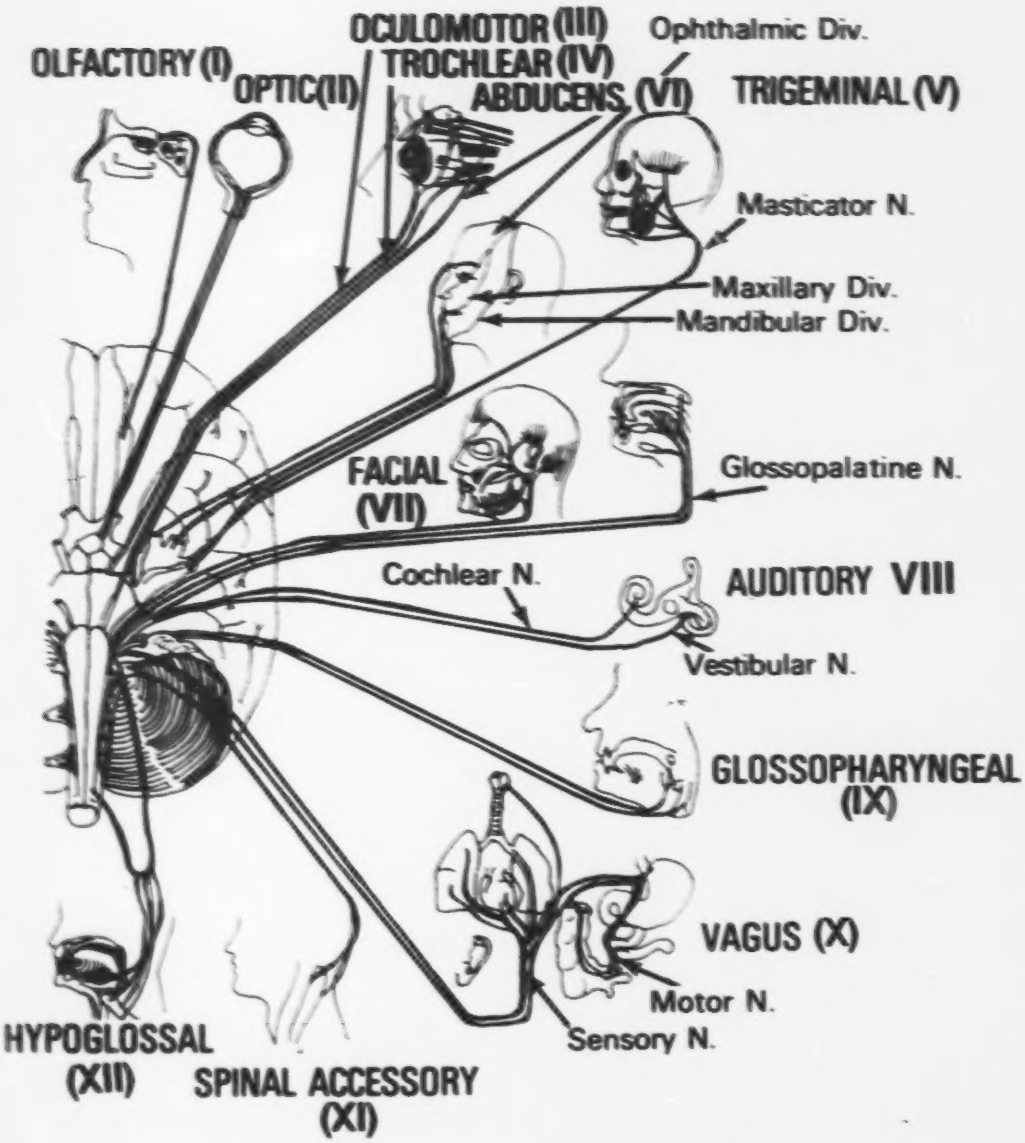

Anterior Horns of Lateral Ventricles
Inferior Horn of Lateral Ventricle
Posterior Horn of Lateral Ventricle

Superior View

Plexuses of the Central Nervous System


Cervical Plexus
Brachial Plexus
Lumbar Plexus
Sacral Plexus
Coccygeal Plexus

Cranial Nerves


OCULOMOTOR (III)
Ophthalmic Div.
OLFACTORY (I)
OPTIC (II)
TROCHLEAR (IV)
ABDUCENS (VI)
TRIGEMINAL (V)
Masticator N.
Maxillary Div.
Mandibular Div.
FACIAL (VII)
Glossopalatine N.
Cochlear N.
AUDITORY VIII
Vestibular N.
GLOSSOPHARYNGEAL (IX)
VAGUS (X)
Motor N.
Sensory N.
HYPOGLOSSAL (XII)
SPINAL ACCESSORY (XI)

Nervous System
Unit 6

Information Sheet

1. **Terms and definitions**

   a. **Affectors** — Cells functioning in reception of stimuli; receiving end of sensory nerves

   b. **Axon** — Part of the neuron that conducts impulses away from the cell body; each cell has one

   c. **Autonomic nervous system** — Automatically regulates the action of the glands, the smooth muscles of the hollow organs, and the heart, often without one being aware of it

   d. **Cell body** — Part of the neuron that acts as a sending and receiving center, carries on metabolism, and stores energy

   e. **Central nervous system** — Consists of nerve tissues that form the brain and spinal cord; controls voluntary acts

   f. **Cerebral cortex** — Outer layer of gray matter of the cerebrum

   g. **Cerebrospinal fluid** — Watery fluid protecting the brain and spinal cord

   h. **Dendrite** — Part of the neuron that carries impulses to the cell body

   i. **Effectors** — Nerve endings that carry out actions

   j. **Electroencephalogram (EEG)** — A tracing of the electrical activity of an individual's brain

   k. **Fissure** — A deep groove or furrow in an organ such as the brain

   l. **Ganglion** — Mass of nerve tissue, principally nerve cell bodies, outside the central nervous system

   m. **Gray matter** — Nerve tissue of a grayish color consisting primarily of nonmyelinated nerve fibers; contains large numbers of cell bodies of neurons

   n. **Hemisphere** — Either half of the cerebrum or cerebellum

   o. **Lobe** — A fairly well-defined part of an organ such as the brain separated by boundaries

Information Sheet

p. **Meninges** — The tough, 3-layered membrane protecting the spinal cord and the brain

q. **Myelinated** (medullated) — Covered with myelin

r. **Myelin sheath** — Noncellular, fatty covering of a nerve fiber

s. **Myoneural junction** — Ending of a nerve at a muscle

t. **Nerve** — Bundle of nerve fibers, blood vessels, and connective tissue outside the central nervous system

u. **Nerve fibers** — Threadlike projections of cytoplasm from the cell body of a neuron; axons and dendrites

v. **Nervous system** — System of the body dealing with the brain, spinal cord, and nerves which coordinates body activities

w. **Neuroglia** — Supporting structure for nerve tissue consisting of blood vessels, connective tissue, and specialized cells found only in the brain and spinal cord

x. **Neurology** — Study of the nervous system

y. **Neuron** — Basic nerve cell

z. **Peripheral nervous system** — Provides input from sensory receptors to the central nervous system and output from the central nervous system to effectors

aa. **Plexus** — A network of nerves

bb. **Regeneration** — Repair, regrowth, or restoration of a part

cc. **Stimulus** — Any agent or influence that produces a response or increase in activity in living protoplasm

dd. **Sulcus** — A slight groove, furrow, or depression in an organ, especially of the brain

ee. **Synapse** — Junction of an axon and one or more dendrites which transmits nerve impulses in one direction only

ff. **Ventricle** — One of the cavities of the brain

gg. **White matter** — Nerve tissue consisting of myelinated nerve fibers

Information Sheet

2. **Functions of the nervous system**

   a. To receive internal and external stimuli through sensory organs

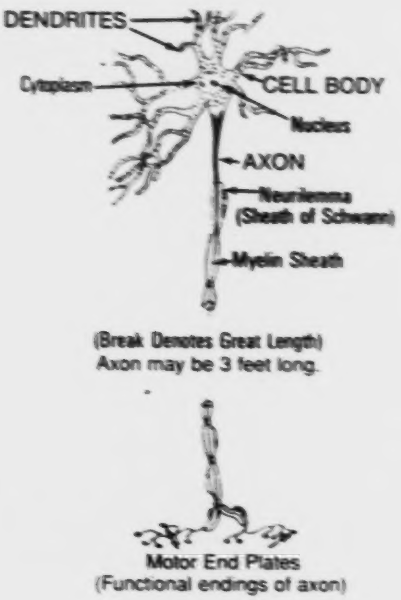
   b. To transmit messages to and from the brain which interprets messages, stores information (if needed), and coordinates response (if needed)

   c. To respond to internal and external stimuli through motor organs

   Note: The nervous system is the master communication system of the body and is responsible for the coordination of all body activities. The nervous system makes all conscious experiences possible such as emotions, learning, and movement.

3. **Parts of a typical neuron and their functions** (Figure 1)

   Figure 1—Typical neuron


DENDRITES
Cytoplasm
CELL BODY
Nucleus
AXON
Neurilemma (Sheath of Schwann)
Myelin Sheath
(Break Denotes Great Length)
Axon may be 3 feet long.
Motor End Plates
(Functional endings of axon)

   a. **Cell body**

      (1) Acts as a sending and receiving center

      (2) Carries on metabolism

      (3) Stores energy

      Note: Cell bodies differ in size according to function.

Information Sheet

b. **Dendrites**

(1) Carry impulses *to* the cell body

(2) Are usually shorter and more numerous than axons

(3) A neuron may have one or more dendrites.

Note: Branched dendrite processes of the cell body differ in number, size, and length depending upon location and function.

c. **Axon**

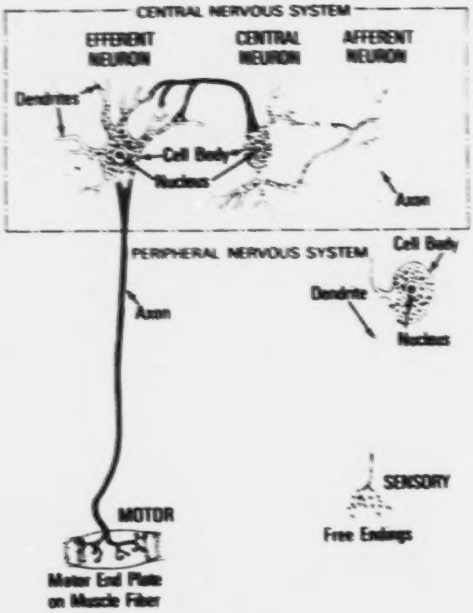
(1) Conducts impulses *away* from the cell body

(2) A neuron NEVER has more than one axon.

Note: An axon may be as long as a meter.

4. **Types of neurons** (Figure 2)

Figure 2


CENTRAL NERVOUS SYSTEM
EFFERENT NEURON
CENTRAL NEURON
AFFERENT NEURON
Dendrites
Cell Body
Nucleus
Axon
PERIPHERAL NERVOUS SYSTEM
Cell Body
Dendrite
Nucleus
Axon
SENSORY
Free Endings
MOTOR
Motor End Plate on Muscle Fiber

Information Sheet

a. **Sensory neurons**

   (1) Also called afferent or receptor

   (2) *Receive* messages from all parts of the body and transmit them to the central nervous system

   (3) Controlled by the thalamus, the "sensory" integrating center located below the cerebral hemispheres

b. **Connecting neurons**

   (1) Also called central or internuncial

   (2) Conduct messages or impulses from sensory to motor neurons

   (3) Found only in the central nervous system

c. **Motor neurons**

   (1) Also called efferent

   (2) *Transmit* messages from the central nervous system to all parts of the body

   (3) Located in muscles or glands

   (4) Controlled by frontal lobe of brain

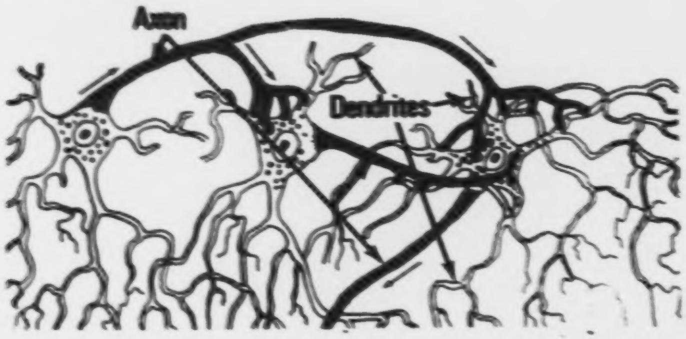
   Note: There are also mixed nerves which contain both afferent and efferent nerve fibers. Spinal and cranial nerves are both mixed nerves.

Information Sheet

5. Transmission of nerve signals

a. When a neuron receives a signal, it sends an impulse on to the next neuron across the synapse between axon and dendrite.

Figure 3—A synapse



b. Two or more neurons arranged in a chain function to conduct impulses from one place to another.

c. Impulses pass only in **one direction** from receptor dendrite to cell body to axon to dendrite and so on.

Note: The speed of nerve impulses is estimated to be about 395 feet per second.

d. When a nerve impulse is blocked, the blocking usually takes place at a synapse.

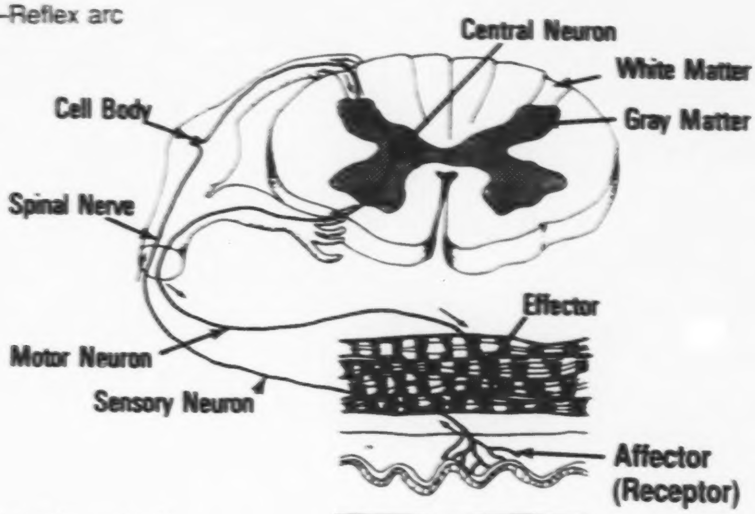
Example of signal transmission:	When the hand touches something hot, the receptors start a message over the afferent neurons to the central nervous system. The connecting neurons of the central nervous system interpret the message and determine the course of action. A further impulse is sent out over the efferent neurons to bring about a proper response, in this instance to remove the hand from the source of heat.

Information Sheet

6. **Components of a reflex arc** (Figure 4)

Note: This is the simplest type of nerve response which is unconscious and involuntary.

Figure 4—Reflex arc


Central Neuron
White Matter
Cell Body
Gray Matter
Spinal Nerve
Effector
Motor Neuron
Sensory Neuron
Affector
(Receptor)

a. Affector (receptor)

b. Sensory neuron

c. Central neuron (in spinal cord)

d. Motor neuron

e. Effector

Examples: Knee jerk or patellar, abdominal, Achilles, biceps, triceps, and plantar reflexes; blinking of eye when something touches it; secretion of saliva at sight or smell of food

Note: Reflex tests are used diagnostically to determine defects in the central nervous system.

Information Sheet

7. Characteristics of a nerve fiber

a. Is an elongated process of a neuron, usually the axon, concerned primarily with the conduction of impulses

b. Nerve fibers form the major portion of the white matter of the brain and spinal cord and all nerves.

c. Most nerve fibers in peripheral nerves are myelinated.

8. Parts of a nerve fiber

a. **Axis cylinder** — Central core of jelly-like material

b. **Myelin sheath** — Fatty covering which provides insulation and speeds impulse conduction

Note: Nerve fibers covered with myelin are called myelinated.

c. **Neurilemma** — Thin membrane with nuclei called Schwann cells completely covering the nerve fiber; regenerates nerve fibers

Note: The neurilemma is lacking in all fibers of the central nervous system.

9. Mechanism of regeneration of peripheral nerves (Figure 5)

Note: Neurons do not multiply as other cells do to replace those destroyed by injury or disease. The nerve fiber can regenerate only if the cell body is intact.

a. Part of the fiber separated from the cell body disintegrates.

b. Neurilemma starts to regenerate at the site of injury.

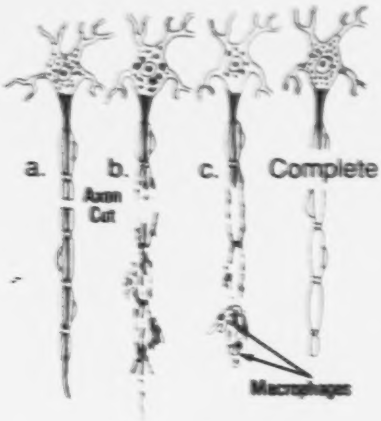
Note: If the cut ends of the neurilemma are not too far apart, they grow together to re-establish the neurilemmar tube.

c. Remaining stump of the axon attached to the cell body is able to grow in the repaired tube.

Note: A surgeon may be able to aid in the regeneration process by aligning the cut ends of a nerve and in some cases the gap of injury can be spanned by artificial tubes. The regeneration process is slow, with an approximate rate of 1.5 mm per day.

Information Sheet

Figure 5—Regeneration of a nerve fiber



10. **Two main divisions of nervous system**

    a. **Central nervous system (CNS)**

        (1) Brain

        (2) Spinal cord

    b. **Peripheral nervous system (PNS)**

        (1) Cranial nerves

            (a) 12 pairs
            (b) Carry impulses to and from the brain

        (2) Spinal nerves

            (a) 31 pairs
            (b) Carry messages to and from the spinal cord

        (3) Autonomic nerves (ganglia and fibers)

            (a) Can be referred to as the autonomic nervous system (ANS)

            (b) Lie on either side of the spinal cord

(c) Has two subdivisions

1) Sympathetic division (thoracolumbar)
2) Parasympathetic division (craniosacral)

(d) Has to do largely with activities which go on more or less automatically

(e) Controlled by hypothalamus

Note: Both divisions of the autonomic nervous system consist of two sets of neurons, preganglionic and postganglionic. Both are efferent.

11. Constituents found in the spinal canal

a. Spinal cord

b. Cerebrospinal fluid

c. Meninges

d. Adipose tissue

e. Blood vessels

12. Characteristics of the spinal cord

a. Is a small cord about 18 inches long in the adult

b. Lies within the spinal canal surrounded by the vertebrae

c. Acts as a great conduction pathway of impulses between the peripheral nerves to and from the brain

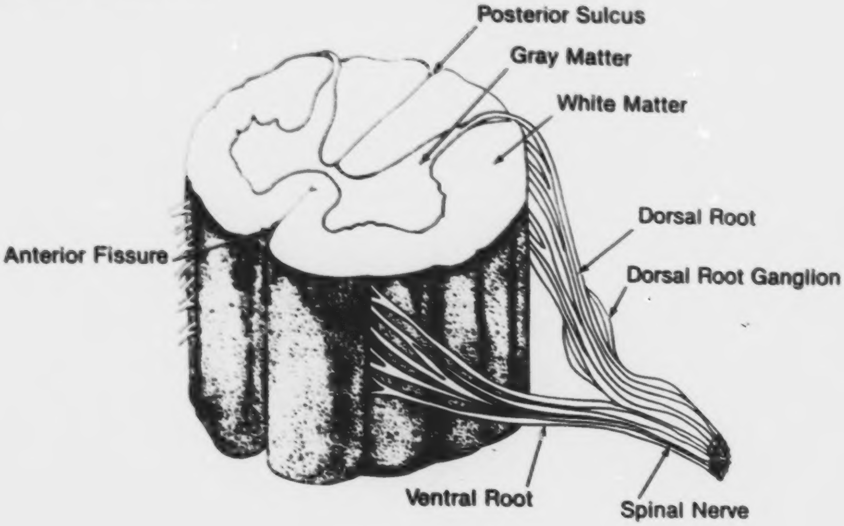
Note: The spinal cord functions in all sensations and all movements of the body.

d. Cross section of the spinal cord reveals an inner H-shaped area of gray matter (primarily cell bodies) surrounded by an outer region of white matter (primarily myelinated nerve fibers).

Information Sheet

e. Spinal nerves emerge from the cord by two short roots, the dorsal root (sensory) and the ventral root (motor).

Figure 6—Spinal cord


Posterior Sulcus
Gray Matter
White Matter
Dorsal Root
Dorsal Root Ganglion
Anterior Fissure
Ventral Root
Spinal Nerve

f. Cord extends from the medulla to the lower border of first lumbar vertebra or top of second lumbar vertebra where it begins to taper into a "horse tail" of fibers that finally end in the coccygeal area.

Note: The technical name for the "horse tail" is the *cauda equina*.

g. In the embryo, the spinal cord occupies the entire spinal column extending down into the tail portion of the vertebral column. However, bone tissue grows more rapidly than nerve tissue so by adulthood the cord only reaches to the level of the first or second lumbar vertebra.

h. Spinal anesthetics are given between third and fourth or fourth and fifth lumbar vertebrae.

Note: Spinals are given at this point because the cord ends above the second lumbar vertebra. The canal is empty except for the circulating cerebrospinal fluid which takes the anesthetic to the brain.

Information Sheet

13. **Components of cerebrospinal fluid**
    - a. Water
    - b. Glucose
    - c. Sodium chloride
    - d. Protein
    - e. Some waste products such as urea

14. **Purpose of cerebrospinal fluid** — To circulate around the brain and spinal cord maintaining an even pressure and acting as a cushion or shock absorber

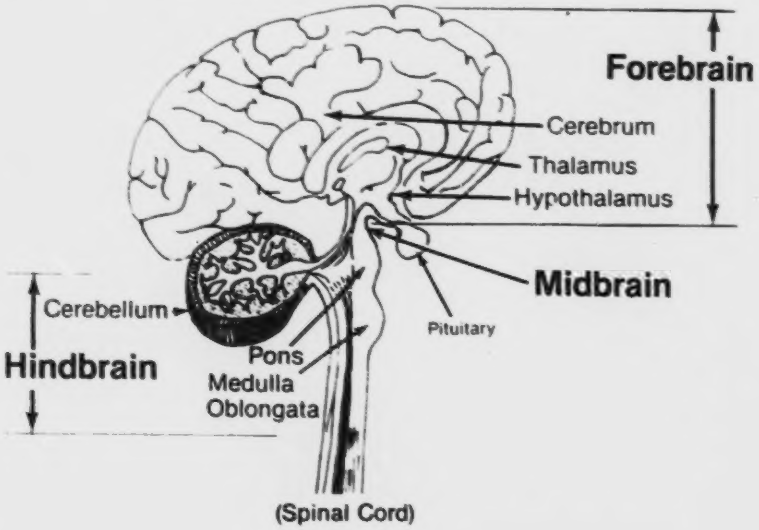
15. **Layers of the meninges**
    - a. **Dura mater**
        - (1) Outer layer
        - (2) Provides protection
    - b. **Arachnoid**
        - (1) Middle layer
        - (2) Resembles a cobweb with cerebrospinal fluid filling the subarachnoid space under it
    - c. **Pia mater**
        - (1) Inner layer
        - (2) Is a thin vascular layer containing blood vessels which bring oxygen and carry away waste products

Information Sheet

16. **Parts of the brain** (Figure 7)

Note: Gray matter makes up the exterior of the brain and white matter makes up the interior.

Figure 7—Sagittal section of the brain


Forebrain
Cerebrum
Thalamus
Hypothalamus
Midbrain
Pituitary
Cerebellum
Hindbrain
Pons
Medulla
Oblongata
(Spinal Cord)

a. Forebrain

   (1) Cerebrum (Telencephalon)

   Note: This is the largest part of the human brain.

   (2) Thalamus } (Diencephalon)

   (3) Hypothalamus } (Diencephalon)

b. Midbrain (Mesencephalon)

c. Hindbrain (Rhombencephalon)

   (1) Pons

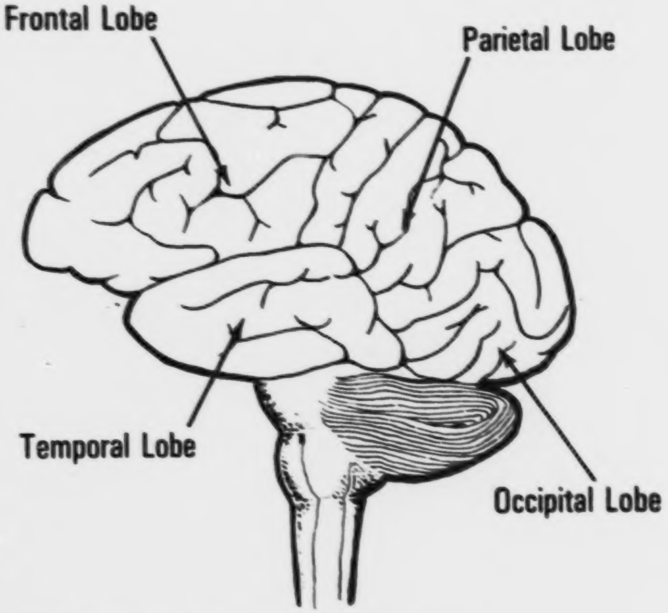
   (2) Medulla oblongata

   (3) Cerebellum

Information Sheet

17. **Lobes of the cerebral hemisphere** (Figure 8)

Figure 8


Frontal Lobe
Parietal Lobe
Temporal Lobe
Occipital Lobe

Note: The central lobe is not shown in this illustration.

a. Frontal

b. Parietal

c. Temporal

d. Occipital

e. Central (Island of Reil)

Note: The Island of Reil is the triangular area of the cerebral cortex that forms the floor of the lateral cerebral fossa.

Information Sheet

18. Functions of the different parts of the brain

Note: The left side of the brain controls the right side of the body. The right side of the brain controls the left side of the body.

a. **Forebrain**

(1) Frontal lobe of cerebrum — Controls voluntary muscles and judgement

(2) Parietal lobe of cerebrum — Controls sensory functions such as pain, touch, and temperature interpretation

(3) Temporal lobe of cerebrum — Controls hearing, smell, and taste

(4) Occipital lobe of cerebrum — Controls vision

(5) Thalamus — Serves as relay center and monitors sensory stimuli

(6) Hypothalamus — Controls body temperature, water balance, sleep, appetite, some emotions such as fear and pleasure, and both divisions of the autonomic nervous system

Note: The thalamus and hypothalamus lie between the hemispheres of the cerebrum in an area known as the diencephalon.

b. **Midbrain** — Serves as reflex center

Note: This is the site of third and fourth cranial nerve nuclei.

c. **Hindbrain**

(1) Pons — Relays impulses between the cerebrum and cerebellum, and the cerebrum and medulla oblongata

Note: The pons is the site of cranial nerves V, VI, VII, and VIII.

(2) Medulla oblongata — Controls *vital* functions such as breathing, heart rate, blood pressure, swallowing, and coughing

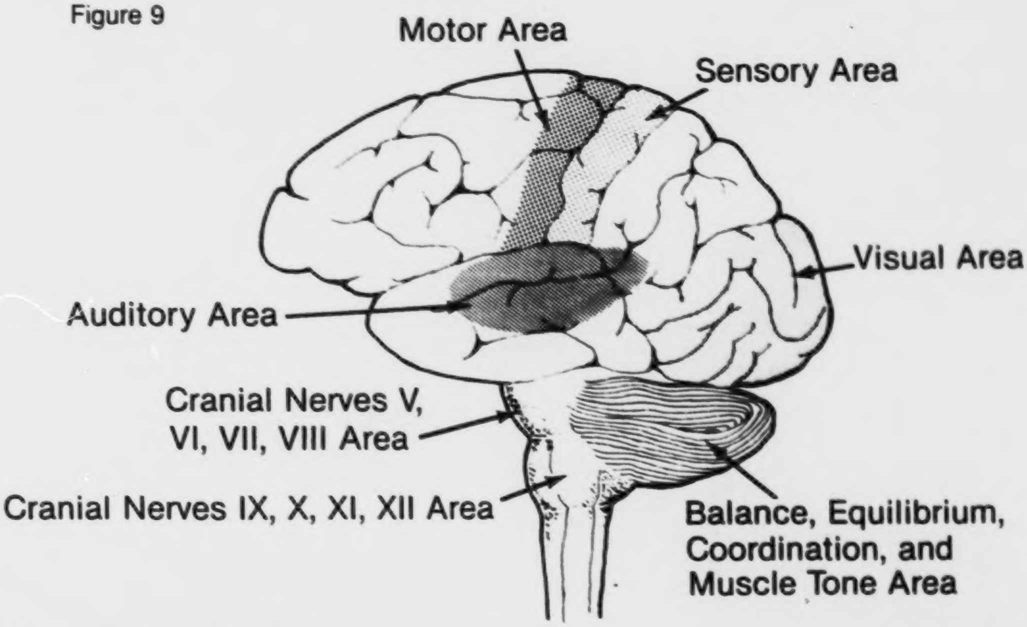
Note: This is the site of cranial nerves IX through XII. The medulla oblongata is considered the most vital part of the brain.

(3) Cerebellum — Maintains body balance, equilibrium, coordination, and muscle tone

Information Sheet

19. **Functional areas of the brain** (Figure 9)

Figure 9


Motor Area
Sensory Area
Visual Area
Auditory Area
Cranial Nerves V, VI, VII, VIII Area
Cranial Nerves IX, X, XI, XII Area
Balance, Equilibrium, Coordination, and Muscle Tone Area

20. **Fissures of the brain**

    a. **Longitudinal fissure** — The deep fissure between the cerebral hemispheres

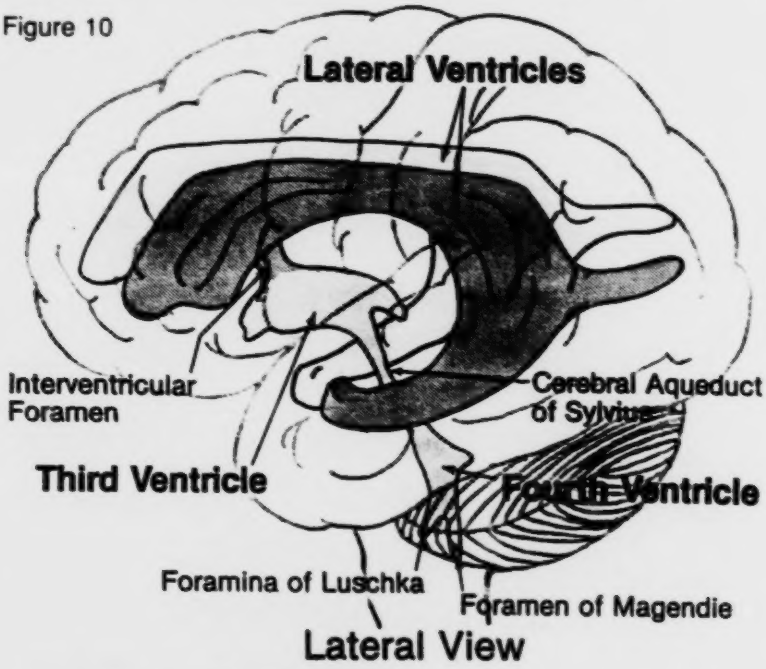
    b. **Central fissure** (Fissure of Rolando) — At a right angle to the longitudinal fissure

    c. **Lateral fissure** (Fissure of Sylvius) — Separates temporal lobe from rest of cerebral hemisphere

Information Sheet

21. Characteristics of the ventricles of the brain (Figure 10)

Figure 10


Lateral Ventricles
Interventricular Foramen
Cerebral Aqueduct of Sylvius
Third Ventricle
Fourth Ventricle
Foramina of Luschka
Foramen of Magendie
Lateral View

a. Are four cavities in the brain

    (1) Two lateral ventricles (first and second)

    (2) Third ventricle

    (3) Fourth ventricle

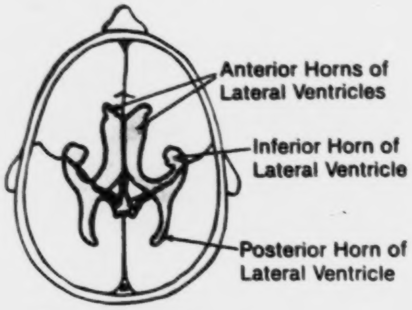
b. Are filled with cerebrospinal fluid

c. Are continuous with the central canal of the spinal cord

d. The lateral ventricles are located inside the cerebral hemispheres.

e. Each lateral ventricle possesses a posterior, anterior, and inferior horn.

Figure 11


Anterior Horns of Lateral Ventricles
Inferior Horn of Lateral Ventricle
Posterior Horn of Lateral Ventricle

Superior View

(1) The posterior horn extends into the occipital lobe.

(2) Anterior horn extends into the frontal lobe.

(3) Inferior horn extends into the temporal lobe.

f. Each lateral ventricle communicates with the third ventricle by way of the interventricular foramen.

g. The third ventricle is located in the diencephalon (with the thalamus and hypothalamus).

h. The cerebral aqueduct of Sylvius connects the third ventricle with the fourth ventricle.

i. The fourth ventricle lies between the cerebellum and the pons and medulla.

j. The fourth ventricle is continuous with the central canal of the spinal cord. It also communicates with the subarachnoid space of the spinal canal through three foramina.

(1) One medial — Foramen of Magendie

(2) Two lateral — Foramina of Luschka

k. Inside each ventricle are tiny masses of specialized capillaries called choroid plexuses.

l. The choroid plexuses secrete the cerebrospinal fluid.

Information Sheet

22. Blood supply to the brain

a. Four arteries, two internal carotids and two vertebrals, unite to form the Circle of Willis at the base of the brain.

b. Circular arrangement of the arteries equalizes the circulation of blood and provides an alternate passageway for blood in case of blockage of one of the arteries.

c. Approximately 15 percent of the total output of the heart is needed by the brain for normal function.

Note: Either too little oxygen or too much carbon dioxide causes dilation of the arteries of the brain permitting more blood to reach the brain.

d. Numerous centers of function in the brain require an adequate supply of oxygen at all times.

Note: If the blood supply to the brain is halted for six to ten minutes, irreversible changes take place.

23. Names and numbers of pairs of spinal nerves

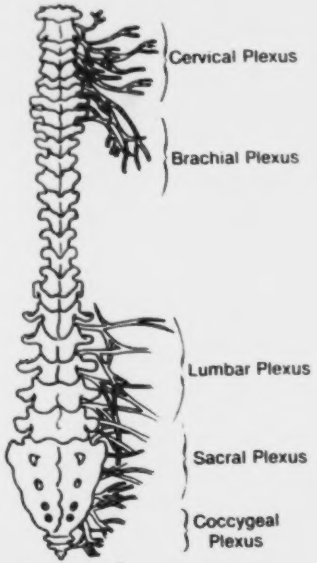
Note: The spinal nerves are named according to the segment of spinal cord to which they are attached.

NAME	NUMBER OF PAIRS
Cervical	8
Thoracic	12
Lumbar	5
Sacral	5
Coccygeal	1
	31 pairs total

Information Sheet

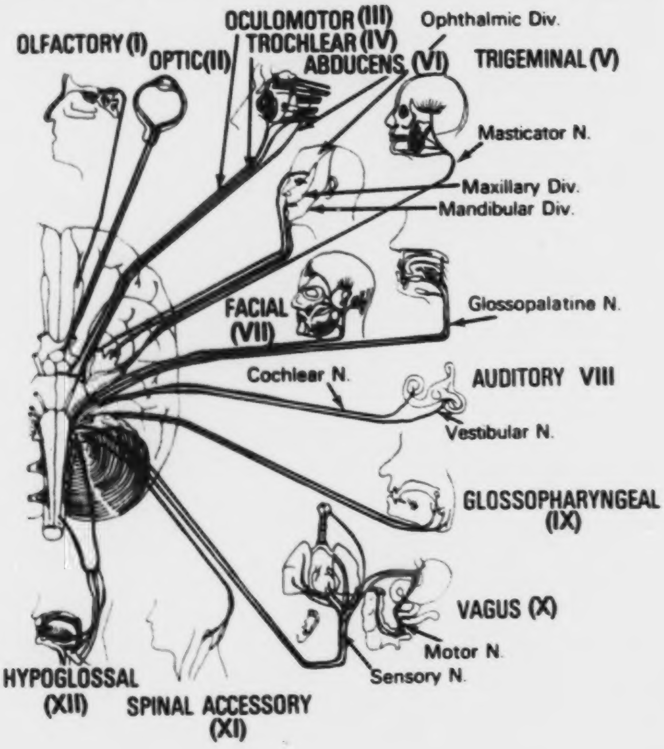
24. **Plexuses of the central nervous system** (Figure 12)

Figure 12


Cervical Plexus
Brachial Plexus
Lumbar Plexus
Sacral Plexus
Coccygeal Plexus

25. **Names, numbers, and specific functions of cranial nerves** (Figure 13

Figure 13


OLFACTORY (I)
OPTIC (II)
OCULOMOTOR (III)
TROCHLEAR (IV)
ABDUCENS (VI)
Ophthalmic Div.
TRIGEMINAL (V)
Masticator N.
Maxillary Div.
Mandibular Div.
FACIAL (VII)
Glossopalatine N.
Cochlear N.
AUDITORY VIII
Vestibular N.
GLOSSOPHARYNGEAL (IX)
VAGUS (X)
Motor N.
Sensory N.
HYPOGLOSSAL (XII)
SPINAL ACCESSORY (XI)

Information Sheet

NAME	NUMBER	FUNCTION
Olfactory	I	Sense of smell
Optic	II	Sense of sight
Oculomotor	III	Controls part of the eyeball muscles
Trochlear	IV	Controls one eyeball muscle
Trigeminal	V	Three branches supply cornea and conjunctiva, upper portion of face, ear, lower lip, teeth, and gums, and muscles for chewing
Abducens	VI	Controls lateral eye movement
Facial	VII	Supplies facial muscles, middle ear, and taste
Auditory	VIII	Sense of hearing and balance
Glossopharyngeal	IX	Taste, swallowing
Vagus	X	Swallowing, hunger, speech muscles, breathing, heart rate, peristalsis, and control of glands in stomach and pancreas
Spinal accessory	XI	Controls muscles of neck and upper back
Hypoglossal	XII	Controls tongue muscles

26. Subdivisions of autonomic nervous system

a. Parasympathetic or craniosacral division

(1) Fibers arise from midbrain or medulla and from sacral region of the cord out to the ganglia which lie on or near the viscera, blood vessels, and glands.

(2) Functions while body is at rest and under no stress. All organs and systems function at normal rate.

(3) Usually acts as a balance for the sympathetic division

Information Sheet

b. **Sympathetic or thoracolumbar division** (Fight or Flight)

(1) Includes centers which lie laterally to the anterior surface of the spinal column from the cervical, thoracic, and lumbar regions of the spinal cord and preganglionic fibers arising from these centers

(2) Includes sympathetic ganglia and their fibers

(3) Includes great plexuses that are stimulated by impulses from the sympathetic ganglia

(4) Acts as an accelerator which increases activity of organs

(5) Functions during periods of stress, strenuous exercise, fatigue, and anger

(6) Constitutes an emergency mechanism in the body

Nervous System
Unit 6

Student Supplement 1—Identify the Parts of a Neuron

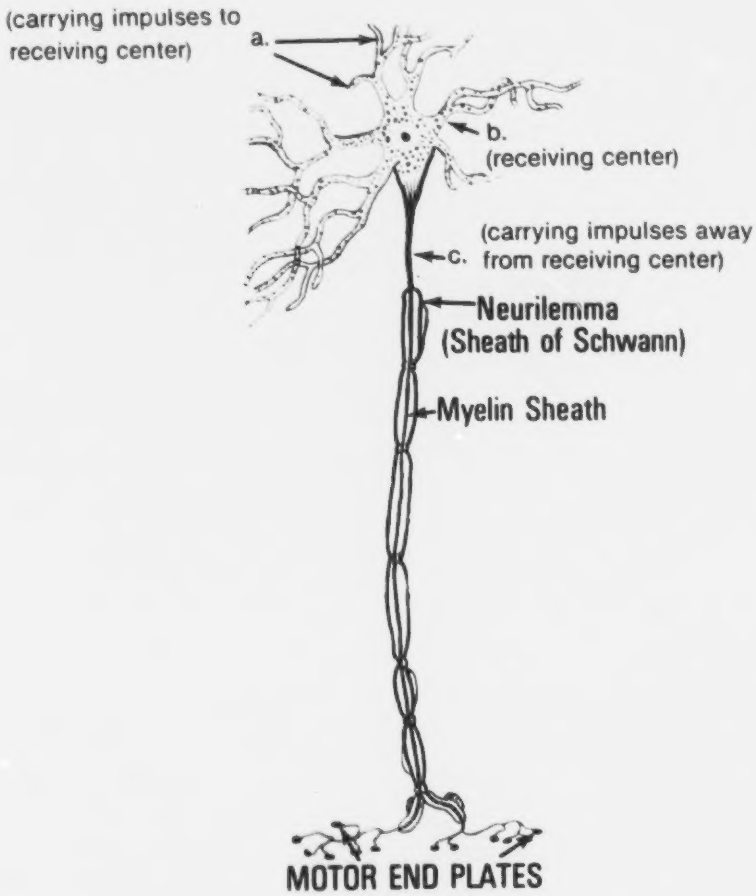
Name ______________________________

Directions: Identify the parts of a neuron in the following illustration, and place your answers in the blanks provided.

a. ______________________________

b. ______________________________

c. ______________________________


(carrying impulses to receiving center)
a.
b.
(receiving center)
c.
(carrying impulses away from receiving center)
Neurilemma (Sheath of Schwann)
Myelin Sheath
MOTOR END PLATES

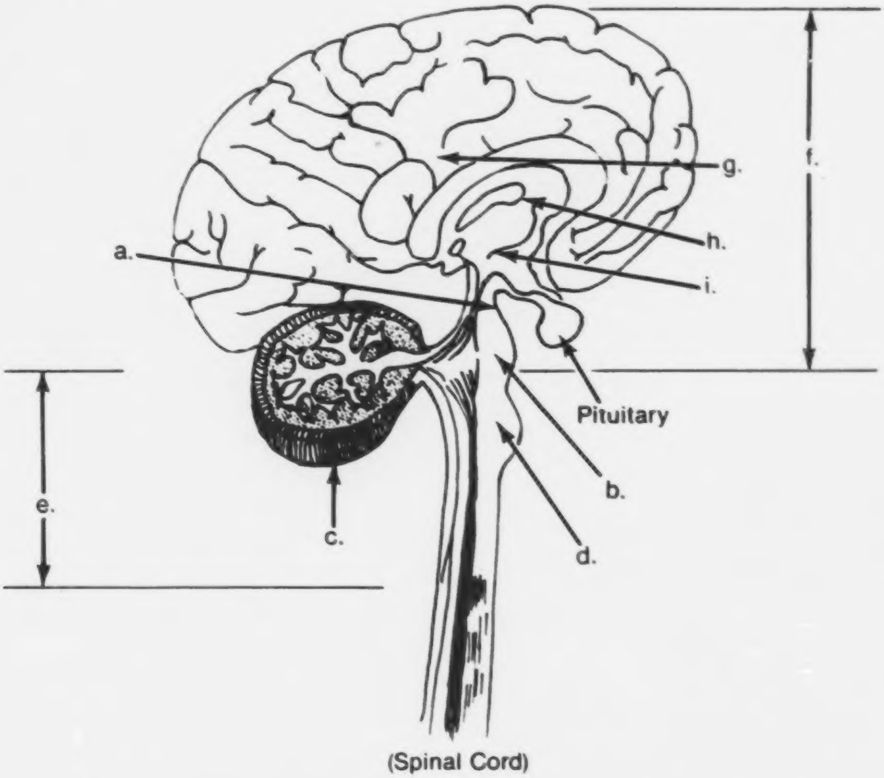
Nervous System
Unit 6

Student Supplement 2—Identify the Parts of the Brain

Name ______________________________

Directions: Identify the parts of the brain in the illustration below, and place your answers in the blanks provided.

a. ______________________
b. ______________________
c. ______________________
d. ______________________
e. ______________________
f. ______________________
g. ______________________
h. ______________________
i. ______________________


g.
f.
h.
a.
i.
Pituitary
e.
b.
c.
d.
(Spinal Cord)

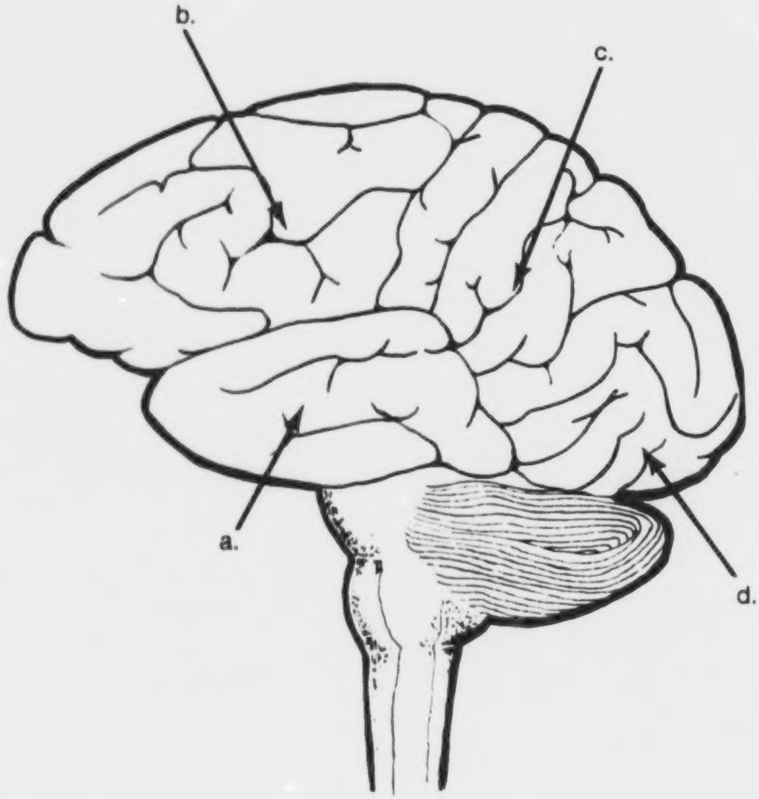
Nervous System
Unit 6

Student Supplement 3—Identify the Lobes of the Cerebral Hemisphere

Name ______________________________

Directions: Identify the lobes of the cerebral hemisphere shown in the following illustration, and place your answers in the blanks provided.

a. ______________________________
b. ______________________________
c. ______________________________
d. ______________________________
e. Which lobe is not shown? ______________________________



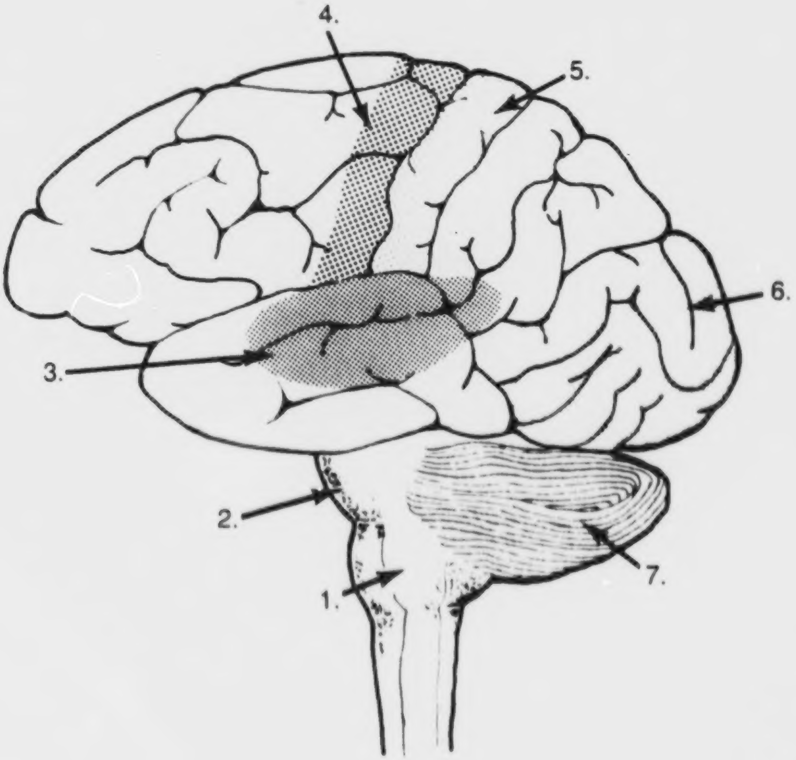
Nervous System
Unit 6

Student Supplement 4—Identify the Functional Areas of the Brain

Name ____

Directions: Identify the functional areas of the brain shown by matching the parts in the illustration with the correct names below.

______a. Visual area
______b. Auditory area
______c. Motor area
______d. Sensory area
______e. Cranial nerves V-VIII area
______f. Cranial nerves IX-XII area
______g. Balance, equilibrium, coordination, and muscle tone area



Nervous System
Unit 6

Student Supplement 5—Complete Charts on Spinal and Cranial Nerves

Name ________________________________

Directions: Complete the following charts concerning the spinal and cranial nerves.

a. ________________ Nerves	
NAME	NUMBER OF PAIRS
b. ________________	8
Thoracic	c. ______
Lumbar	d. ______
e. ________________	5
f. ________________	1
	g. ______ pairs total

h. ________________ Nerves		
NAME	NUMBER	FUNCTION
i. ________________	I	Sense of smell
Optic	II	j. ______________________________
k. ________________	III	Controls part of the eyeball muscles
l. ________________	IV	Controls one eyeball muscle
m. ________________	V	Three branches supply cornea and conjunctiva, upper portion of face, ear, lower lip, teeth, and guns, and muscles for chewing

Student Supplement 5

NAME	NUMBER	FUNCTION
Abducens	VI	n. ______________________________
o. ____________________	VII	Supplies facial muscles, middle ear, and taste
p. ____________________	VIII	q. ______________________________
r. ____________________	IX	s. ______________________________
t. ____________________	X	Swallowing, hunger, speech muscles, breathing, heart rate, peristalsis, and control of glands in stomach and pancreas
Spinal accessory	XI	u. ______________________________ ______________________________
Hypoglossal	XII	v. ______________________________

Nervous System
Unit 6

Student Supplement 6—Complete Statements Concerning the Nervous System

Name ____

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

______ 1. The functioning unit of the nervous system is the

a. Neuron
b. Myelin sheath
c. Nerve
d. Axon

______ 2. The parasympathetic and sympathetic nervous systems are concerned with control of

a. Voluntary movements
b. The senses
c. Involuntary and automatic functions
d. Both voluntary and involuntary functions of the body

______ 3. A patient who was found in a coma was given a drug to stimulate the respiratory center. The respiratory center is located in the

a. Cerebellum
b. Medulla oblongata
c. Cerebrum
d. Hypothalamus

______ 4. The structure which conducts impulses away from a nerve cell body is called

a. Pons
b. Axon
c. Medulla
d. Dendrite

______ 5. Many vital reflexes have their center in the

a. Cerebellum
b. Cerebrum
c. Pons
d. Medulla oblongata

Student Supplement 6

______ 6. The part of the brain that serves as a reflex center for muscle coordination and equilibrium is the

a. Medulla oblongata
b. Cerebellum
c. Cerebrum
d. Pons

______ 7. Messages of touch or smell are carried to the brain by the nerves classified as

a. Motor
b. Cranial
c. Sensory
d. Peripheral

______ 8. The function of the cerebrospinal fluid which would be described as protective is one that provides for

a. A source of food to the brain
b. Getting rid of the products of brain metabolism
c. Cushioning the brain and spinal cord against injury
d. Equalizing the pressure on the brain

______ 9. When a lumbar puncture is performed for the purpose of obtaining a specimen of spinal fluid, the needle is usually inserted between the third and fourth lumbar vertebra because

a. There is no spinal fluid below this point.
b. The spinal cord can be penetrated most easily at this level.
c. The spinal cord ends above the second lumbar vertebrae.
d. The vertebrae are small at this level.

______ 10. An important function of the myelin sheath is to

a. Carry messages to the brain
b. Carry impulses to the cell body
c. Provide insulation and speed impulse conduction
d. Carry messages away from the brain

______ 11. The central nervous system is made up of the

a. Spinal cord and spinal nerves
b. Brain and cranial nerves
c. Brain and spinal cord
d. Cranial nerves and spinal nerves

Student Supplement 6

______12. The point of contact between the axon of one neuron and the dendrites of another neuron is called a

a. Glioma
b. Synapse
c. Myelin sheath
d. Reflex arc

______13. Efferent nerves are those which

a. Affect personality
b. Control functions of the glands
c. Control vasoconstriction
d. Carry impulses from the brain or spinal cord to muscles and glands

______14. The cerebrum is

a. Below the midbrain
b. The gray part of the brain
c. The largest part of the brain
d. Connected to the spinal cord

______15. A function of the hypothalamus is to

a. Control voluntary muscles and judgments
b. Control body temperature, sleep, some emotions, and both divisions of the autonomic nervous system
c. Control vision
d. Control hearing, smell, and taste

______16. Thinking and making decisions are done in the part of the brain called the

a. Cerebellum
b. Cerebrum
c. Medulla
c. Ganglion

______17. The end of a nerve cell that receives messages is called the

a. Axon
b. Cyton
c. Brush
d. Dendrite

Student Supplement 6

______18. Afferent nerves transmit messages

a. To the brain
b. Away from the central nervous system
c. To the heart
d. Toward the central nervous system

______19. Cerebrospinal fluid is secreted by

a. The choroid plexuses in the brain's ventricles
b. Various endocrine glands
c. Lymphatic nodes
d. The meninges

______20. The meninges are

a. Membranes in the brain
b. Three layers of tissue which cover the brain and spinal cord
c. The bony layers of tissue covering the spinal cord
d. Nerve cells on the outer surface of the brain and spinal cord

______21. Which division of the nervous system is composed of the spinal and cranial nerves?

a. Peripheral
b. Autonomic
c. Central
d. Sympathetic

______22. There are ____________ ventricles in the brain.

a. Two
b. Four
c. Five
d. Ten

______23. The pons

a. Is the most vital reflex center
b. Is a part of the conduction pathway between the spinal cord and the brain
c. Regulates body temperature
d. Receives auditory impulses

Student Supplement 6

______24. One function of the spinal cord is to

a. Control balance
b. Conduct impulses from various nerves to the brain
c. Control thinking
d. Control facial muscle movement

______25. The division of the autonomic nervous system which regulates the body when it is under stress and prepares it for "flight or fight" is the

a. Sympathetic
b. Parasympathetic
c. Voluntary
d. Involuntary

______26. The basic physiological unit of the nervous system is composed of

a. A cell body, one dendrite, several axons
b. A cell body, several axons, several dendrites
c. A cell body, one axon, several dendrites
d. A cell body, several axons, several dendrites, and neurofibrils

______27. A ganglion may be defined as

a. A group of nerve cells outside the brain and spinal cord
b. The interlacing of an axon and dendrite
c. Nerve endings
d. A "bump"

______28. The layer of the meninges which lies in intimate contact with the brain is the

a. Pia mater
b. Dura mater
c. Arachnoid mater
d. Subarachnoid mater

______29. There are ____________ lobes of the cerebrum.

a. One
b. Five
c. Three
d. Four

______30. Which of the following is correctly termed the "sensory" integrating center?

a. Hypothalamus
b. Medulla
c. Thalamus
d. Cerebellum

Student Supplement 6

______31. There are ____________ pairs of spinal nerves.

a. 27
b. 31
c. 12
d. 28

______32. There are ____________ pairs of cranial nerves.

a. 31
b. 24
c. 12
d. 18

______33. The center for sight is located in the

a. Temporal lobe
b. Frontal lobe
c. Occipital lobe
d. Parietal lobe

______34. The deep groove which divides the cerebrum into 2 halves is called the

a. Posterior sulcus
b. Anterior sulcus
c. Fissure of Sylvius
d. Longitudinal fissure

Special Sense Organs
Unit 7

Objective Sheet

Unit Objective

After completing this unit, the student should be able to list the five special senses and their organs and be able to complete statements concerning the special sense organs. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to special sense organs with their correct definitions.
2. Match parts of the sensory mechanism with the correct descriptions.
3. List the five special senses and their organs.
4. Complete statements concerning the layers of the eyeball.
5. Distinguish between the humors of the eyeball.
6. Distinguish between extrinsic and intrinsic eye muscles.
7. Select true statements concerning the accessory structures of the eye.
8. Identify the parts of the ear.
9. Distinguish between the types of conduction used in the process of hearing.
10. Complete statements concerning the sense of smell.
11. Complete statements concerning the sense of taste.
12. Complete statements concerning the sense of touch and pain.

Special Sense Organs
Unit 7

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—The Eye (Objectives 4 and 5)
   TM 2—Eye Muscles and Accessory Structures (Objectives 4-6)
   TM 3—Lacrimal Gland (Objective 7)
   TM 4—The Ear (Objective 8)
   TM 5—The Nose and Sense of Smell (Objective 10)
   TM 6—The Tongue and Taste (Objective 11)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Discuss the anatomy of the special sense organs using the transparencies included in this unit and other illustrations or models available.

2. Obtain from local optometrist or ophthalmologist a color perception chart for students to test themselves for color blindness and a Snellen chart to test vision.

3. Arrange to show films pertaining to the special sense organs which may be available through various national organizations.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis, MO: C. V. Mosby Company, 1987.

2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.

3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.

4. Mammler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Brochures and other supplementary information are available from the following organizations:

    a. American Ophthalmological Society
    c/o W. Banks Anderson, M.D.
    Duke University Eye Center
    Durham, NC 27710
    919-684-3343

    b. American Optometric Association
    243 North Lindbergh Boulevard
    St. Louis, MO 63141
    314-991-4100

    c. National Society to Prevent Blindness
    79 Madison Avenue
    New York, NY 10016

2. Videotapes

    a. *Eyes and Ears*, part of *The Living Body* Series available from:

    Films for the Humanities and Sciences
    P.O. Box 2053
    Princeton, NJ 08543-2053
    800-257-5126 or 609-452-1128

    b. *The Magic Sense*, part of *The Body Human* Series available from:

    Medcom/Trainex
    Box 3225
    Garden Grove, CA 92641
    800-877-1443

3. Software program—*The Eye*, for Apple II's. Uses color graphics and animation. Developed by COMPress. Available from:

    Queue, Inc.
    338 Commerce Drive
    Fairfield, CT 06430
    800-232-2224

Suggested Activities

4. Anatomy charts and models on the special senses are available from many health and science education companies. Two of these companies are as follows:

    a. Health Edco
    P.O. Box 21207
    Waco, TX 76702-1207
    800-299-3366, x295 or 817-776-6461, x295

    b. Nebraska Scientific
    3823 Leavenworth Street
    Omaha, NB 68105
    800-228-7117

Special Sense Organs
Unit 7

Answers to Student Supplements

Student Supplement 1

a. Outer ear
b. Middle ear
c. Inner ear
d. Pinna or auricle
e. External auditory canal
f. Tympanic membrane
g. Stapes
h. Round window
i. Eustachian tube
j. Vestibule
k. Cochlea
l. Oval window
m. Semicircular canals
n. Incus
o. Malleus

Student Supplement 2

1. b
2. d
3. a
4. c
5. a
6. d
7. a
8. c
9. d
10. d
11. b
12. a
13. d
14. d
15. b
16. d
17. c
18. a
19. b
20. a
21. a
22. a
23. d
24. c
25. c
26. a
27. d
28. b
29. b
30. a
31. d
32. b
33. d
34. c

Special Sense Organs
Unit 7

Answers to Written Test

1. a. 18
   b. 11
   c. 10
   d. 12
   e. 6
   f. 8
   g. 3
   h. 1
   i. 2
   j. 14
   k. 15
   l. 4
   m. 7
   n. 9
   o. 21
   p. 5
   q. 20
   r. 17

2. a. 2
   b. 3
   c. 1

3. a. Visual sense — The eye
   b. Hearing sense and equilibrium — The ear
   c. Smell sense — The nose
   d. Taste sense — The tongue
   e. Touch and pain sense — The skin and internal organs

4. a. Sclera
      (1) Cornea
      (2) White
   b. Choroid
      (1) Does
      (2) Iris
   c. Retina
      (1) Lens
      (2) Upon which light rays come to a focus

5. b

6. a. E
   b. I
   c. I
   d. E
   e. I
   f. E
   g. E
   h. I
   i. E

7. a, c, e, f, h

Answers to Written Test

8. a. Outer
   b. Middle
   c. Inner
   d. Pinna or auricle
   e. External auditory canal
   f. Tympanic membrane or eardrum
   g. Cochlea
   h. Semi-circular canals
   i. Incus

9. a. F
   b. A
   c. B
   d. B
   e. F
   f. A
   g. F

10. a. Olfactory
    b. Least
    c. Mucosa
    d. Rapid

11. a. Gustatory
    b. Taste buds
    c. (1) Salty
       (2) Sweet
       (4) Bitter
    d. Ninth

12. a. Skin
    b. Pain
    c. Skin
    d. Viscera
    e. Skin

Special Sense Organs
Unit 7

Written Test

Name ________________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______a. The general faculty by which conditions inside or outside the body are perceived

______b. The science dealing with the eye and its diseases

______c. A physician who specializes in the medical and surgical treatment of disorders of the eye

______d. A person skilled in grinding lenses and fitting glasses

______e. Light rays come to a focus behind the retina; farsightedness

______f. Light rays come to a focus in front of the retina; nearsightedness

______g. Mucous membrane which lines eyelids and coats the front portion of the eyeball

______h. Pertaining to sound or to the sense of hearing

______i. A branch of science dealing with hearing, especially the therapy of individuals having impaired hearing

______j. The science dealing with the ear, its function, and its diseases

______k. The science dealing with the ear, nose, and larynx and their functions and diseases

1. Acoustic
2. Audiology
3. Conjunctiva
4. Equilibrium
5. Gustatory
6. Hyperopia
7. Labyrinth
8. Myopia
9. Olfactory
10. Ophthalmologist
11. Ophthalmology
12. Optician
13. Optometrist
14. Otology
15. Otorhinolaryngology
16. Proprioceptor
17. Referred pain

Written Test

______l. State of balance or rest; condition in which contending forces are equal

______m. Intricate communicating passages of the internal ear

______n. Pertaining to smell

______o. One of the three scroll-like bones which projects medially from the lateral wall of the nasal cavity; also called a nasal concha

______p. Pertaining to sense of taste

______q. Perceptible to the touch

______r. Pain seeming to arise in an area other than its origin

18. Sense
19. Somatic pain
20. Tactile
21. Turbinate

2. Match parts of the sensory mechanism on the right with the correct descriptions.

______a. Specialized nerve ending which receives a stimulus

______b. The pathway which carries impulses from the receptor to the brain

______c. Area of the brain which interprets the impulses as senses

1. Sensory center
2. Receptor
3. Sensory nerve

3. List the five special senses and their organs.

a. ____

b. ____

c. ____

d. ____

e. ____

Written Test

4. Complete the following statements concerning the layers of the eyeball by circling the correct answers.

   a. Outer layer is called (sclera, retina).

      (1) Anterior portion is known as the (cornea, iris).

      (2) The remainder of it is (pink, white).

   b. Middle layer is called (choroid, medulla) coat.

      (1) (Does, Does not) contain blood vessels.

      (2) Anterior portion is modified into three separate structures—ciliary body, suspensory ligament, and (iris, conjunctiva).

   c. Inner layer is called (sclera, retina).

      (1) Receives image formed by the (pupil, lens).

      (2) Structure (upon which light rays come to a focus, which regulates amount of light rays coming in).

5. Distinguish between the humors of the eyeball by placing an "X" next to the description of aqueous humor.

______a. Clear, jelly-like fluid in the posterior cavity of the eye

______b. Watery, transparent liquid that circulates through the anterior cavity of the eye

6. Distinguish between extrinsic and intrinsic eye muscles by placing the following letters next to the correct descriptions: "E" for extrinsic and "I" for intrinsic.

______a. Those that attach to the outside of the eyeball and to the bones of the orbit

______b. Those that are located inside the eyeball itself

______c. Involuntary muscles

______d. Voluntary muscles

______e. Iris

______f. Superior and inferior oblique

Written Test

______g. Superior and inferior rectus

______h. Ciliary body

______i. Medial and lateral rectus

7. Select true statements concerning the accessory structures of the eye by placing an "X" in the appropriate blanks.

______a. Eyebrows and eyelashes give protection against foreign objects entering the eye.

______b. Eyelids are located in back of the eyeball.

______c. Eyelids blink as a result of sensory stimuli to keep out foreign objects.

______d. Eyelids are lined with mucous membrane called papilla.

______e. The angles of the ends of the eyelids are known as the inner and outer canthus.

______f. Lacrimal glands and ducts secrete tears which keep the anterior surface of the eye moist and free from irritating particles.

______g. Lacrimal glands are the size of golf balls and are located in the inner portion of each orbit.

______h. Nasolacrimal ducts are small tubes extending from the lacrimal sacs into the nose to drain tears from the eye into the nose.

8. Identify the parts of the ear on the next page, and place your answers in the blanks provided here.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

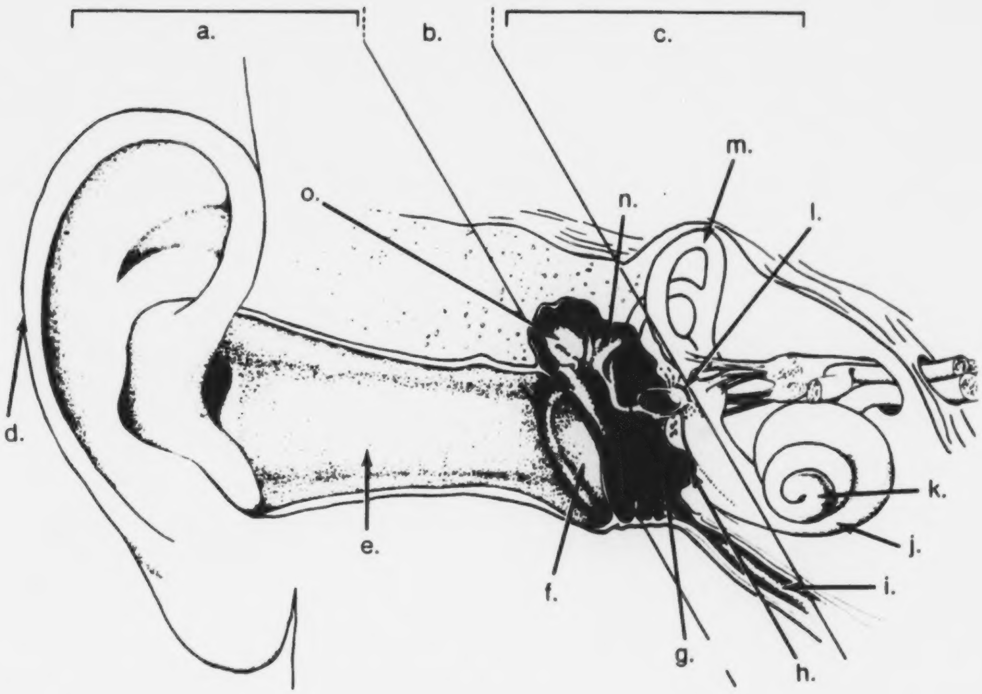
f. ______________________

g. ______________________

h. ______________________

i. ______________________

Written Test



9. Distinguish between the types of conduction used in the process of hearing by placing the following letters next to the correct descriptions: "A" for air, "B" for bone, and "F" for fluid.

______a. Occurs in the inner ear

______b. Occurs in the external ear

______c. Occurs in the middle ear

______d. The chain of ossicles transmits the vibration of the tympanic membrane to the inner ear.

______e. Movement of the fluid in the cochlea stimulates the receptors for hearing (Organ of Corti).

______f. Sound waves come through the external auditory meatus and set the tympanic membrane in vibration.

______g. The receptors set up impulses which are conveyed by the acoustic nerve to the brain where sound is perceived.

Written Test

10. Complete the following statements concerning the sense of smell by circling the correct answers.

    a. Also called the (gustatory, olfactory) sense

    b. The receptors for smell are the (most, least) specialized of the special senses.

    c. The receptors for the first cranial nerve lie in the (bone, mucosa) of the upper part of the nasal cavity.

    d. Adaptation to odors is very (rapid, slow).

11. Complete the following statements concerning the sense of taste by filling in the blanks with the correct answers.

    a. Also called the ________________ sense

    b. The receptors for taste are the ________________ which are located in the papillae of the tongue.

    c. The sense of taste is limited to four fundamental taste sensations localized to four kinds of taste buds.

        (1) ________________—Localized near the tip of the tongue

        (2) ________________—Localized near the tip of the tongue

        (3) Sour—Localized along the sides of the tongue

        (4) ________________—Localized at the back of the tongue

    d. Receptors for taste come from branches of the seventh and ________________ cranial nerves.

12. Complete the following statements concerning the sense of touch by filling in the blanks with the correct answers.

    a. Touch is sensed by receptors of sensory dendrites which are located in the ________________

    b. ________________ receptors, also called nociceptors, give warning of potentially harmful environmental changes.

    c. Nociceptors are located in the ________________ and in the viscera.

    d. Referred pain only occurs from stimulation of deep structures (muscles, fascia, joints, and tendons) or ________________.

    e. Pain from the ________________ is never referred.

***Permission to duplicate this test is granted.**

Special Sense Organs
Unit 7

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

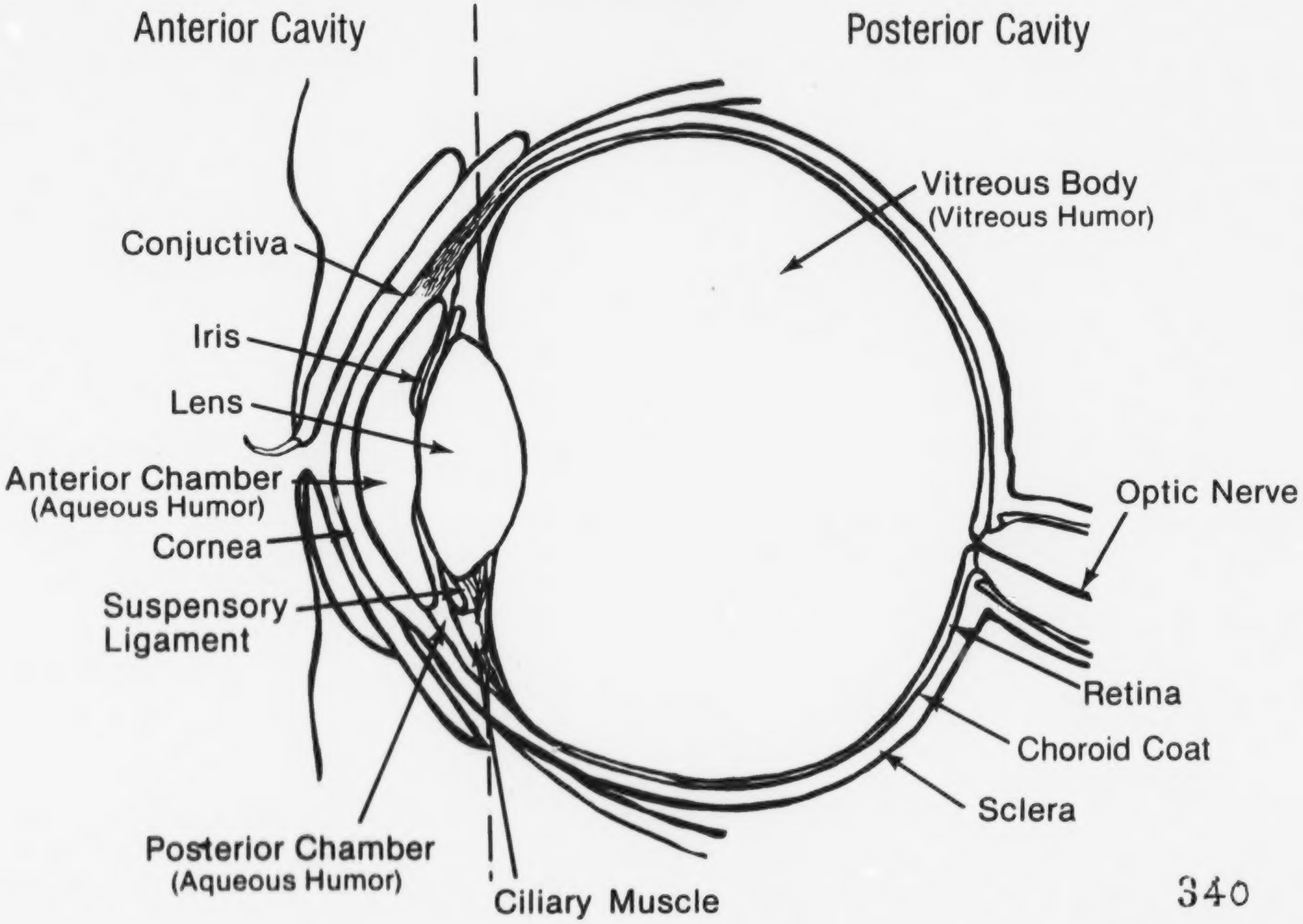
____

Teacher Signature ______________________________ Date __________

Student Signature ______________________________ Date __________

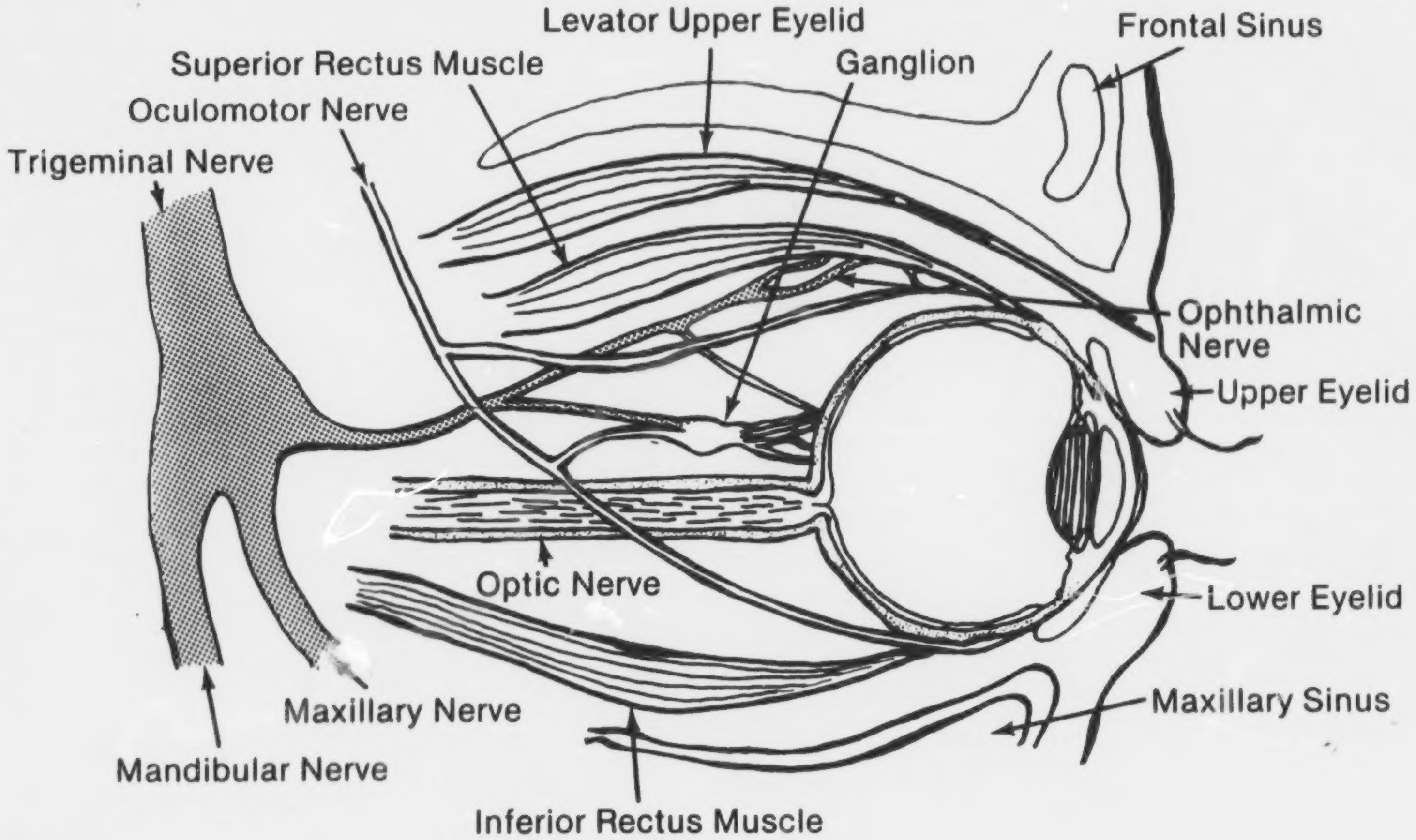
***Permission to duplicate this form is granted.**

The Eye


Anterior Cavity
Posterior Cavity
Vitreous Body
(Vitreous Humor)
Conjuctiva
Iris
Lens
Anterior Chamber
(Aqueous Humor)
Cornea
Suspensory
Ligament
Optic Nerve
Retina
Choroid Coat
Sclera
Posterior Chamber
(Aqueous Humor)
Ciliary Muscle

TM 1

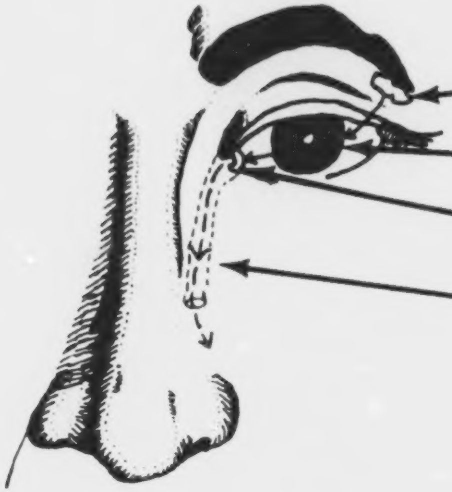
Eye Muscles and Accessory Structures


Levator Upper Eyelid
Frontal Sinus
Superior Rectus Muscle
Ganglion
Oculomotor Nerve
Trigeminal Nerve
Ophthalmic Nerve
Upper Eyelid
Optic Nerve
Lower Eyelid
Maxillary Nerve
Maxillary Sinus
Mandibular Nerve
Inferior Rectus Muscle

Anatomy and Physiology Unit 7
Teacher Page 19

TM 2

Lacrimal Gland

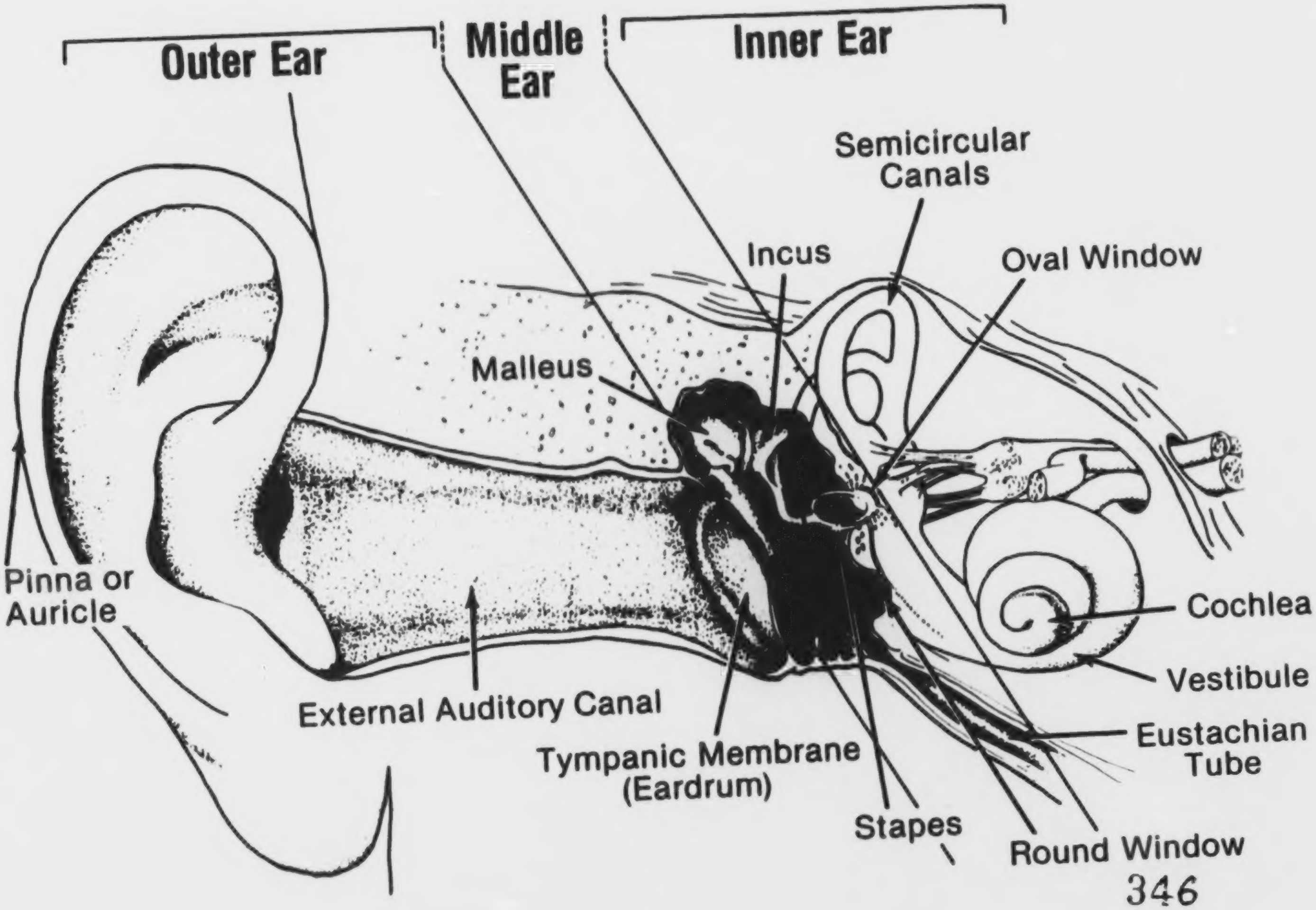


1. Lacrimal Gland Releases Tears
2. Tears Wash over Eyeball
3. Tears Leave Eye Via Lacrimal Duct
4. Wash Down into Nasolacrimal Duct

Anatomy and Physiology, Unit 7
Teacher Page 21

TM 3

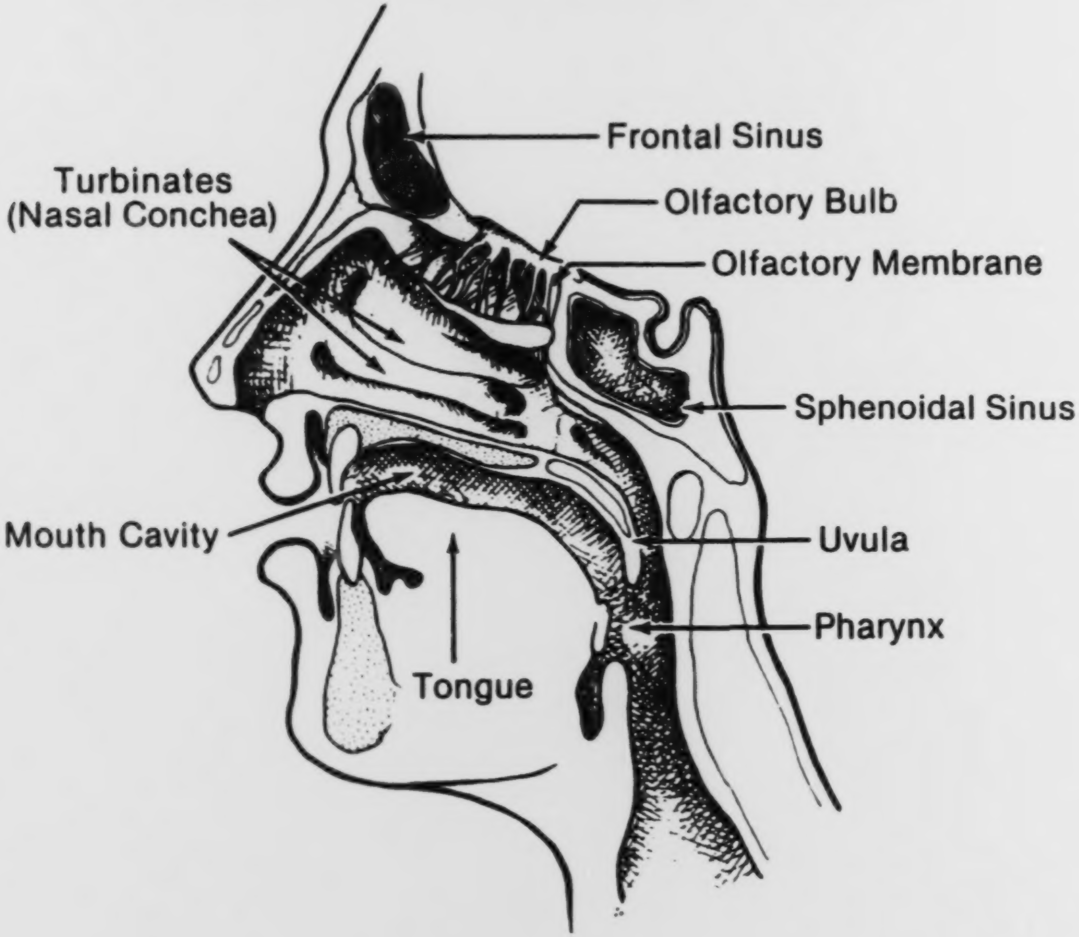
The Ear


Outer Ear
Middle Ear
Inner Ear
Semicircular Canals
Incus
Oval Window
Malleus
Pinna or Auricle
Cochlea
Vestibule
External Auditory Canal
Eustachian Tube
Tympanic Membrane (Eardrum)
Stapes
Round Window

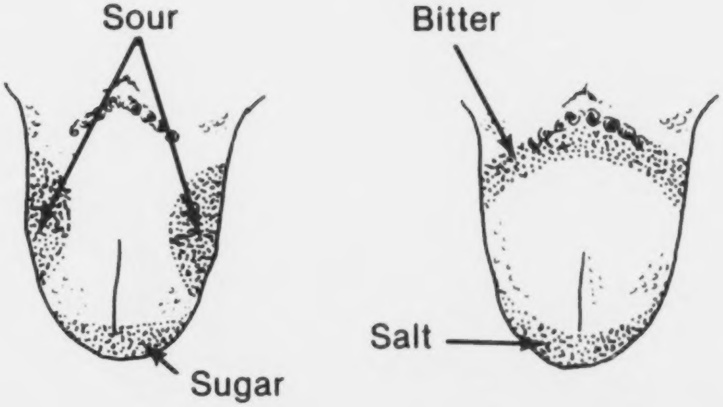
Anatomy and Physiology, Unit 7
Teacher Page 23

TM 4

The Nose and Sense of Smell

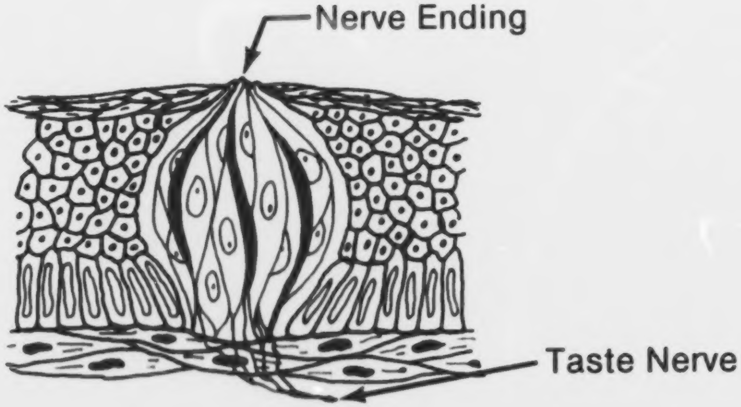

Frontal Sinus
Turbinates (Nasal Conchea)
Olfactory Bulb
Olfactory Membrane
Sphenoidal Sinus
Mouth Cavity
Uvula
Pharynx
Tongue

The Tongue and Taste


Sour
Bitter
Salt
Sugar

Location on the Tongue of the Four Basic Taste Sensations

Enlarged View of a Taste Bud


Nerve Ending
Taste Nerve

Special Sense Organs
Unit 7

Information Sheet

1. **Terms and definitions**

   a. **Acoustic** — Pertaining to sound or to the sense of hearing

   b. **Audiology** — A branch of science dealing with hearing, especially the therapy of individuals having impaired hearing

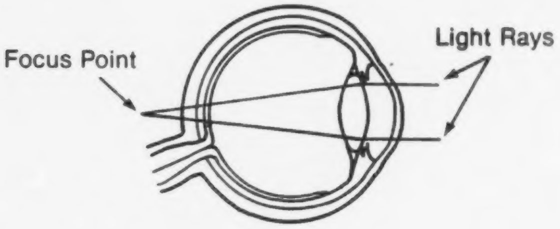
   c. **Conjunctiva** — Mucous membrane which lines eyelids and coats the front portion of the eyeball

   d. **Equilibrium** — State of balance or rest; condition in which contending forces are equal

   e. **Gustatory** — Pertaining to sense of taste

   f. **Hyperopia** — Light rays come to a focus behind the retina; farsightedness

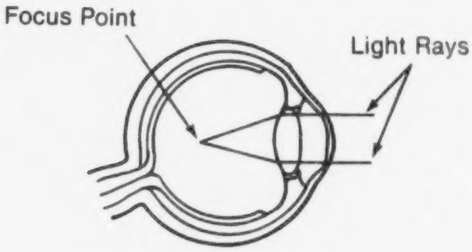
   Figure 1



   g. **Labyrinth** — Intricate communicating passages of the internal ear

   h. **Myopia** — Light rays come to a focus in front of the retina; nearsightedness

   Figure 2



Information Sheet

i. **Olfactory** — Pertaining to smell

j. **Ophthalmologist** — A physician who specializes in the medical and surgical treatment of disorders of the eye

k. **Ophthalmology** — The science dealing with the eye and its diseases

l. **Optician** — A person skilled in grinding lenses and fitting glasses

m. **Optometrist** — A person specially trained and licensed to examine the eyes for vision problems and to prescribe and adapt lenses to correct vision problems; professional degree is Doctor of Optometry — O.D.

n. **Otology** — The science dealing with the ear, its function, and its diseases

o. **Otorhinolaryngology** — The science dealing with the ear, nose, and larynx and their functions and diseases

Note: This is also called otolaryngology.

p. **Proprioceptor** — A receptor that responds to stimuli originating within the body itself, especially those responding to pressure, position, or stretch

Example: Labyrinthine receptors

q. **Referred pain** — Pain seeming to arise in an area other than its origin

r. **Sense** — The general faculty by which conditions inside or outside the body are perceived

s. **Somatic pain** — Pain pertaining to structures of the body wall

t. **Tactile** — Perceptible to the touch

u. **Turbinate** — One of the three scroll-like bones which projects medially from the lateral wall of the nasal cavity; also called a nasal concha

2. **Parts of the sensory mechanism and their descriptions**

a. **Receptor** — Specialized nerve ending which receives a stimulus

Examples of stimuli: Light, sound, odors, chemical substances

b. **Sensory nerve** — The pathway which carries impulses (messages) from the receptor to the brain

c. **Sensory center** — Area of the brain which interprets the impulses (messages) as senses (sensations)

Information Sheet

3. **Special senses and their organs**

   a. Visual sense — The eye

   b. Hearing sense and equilibrium — The ear

   c. Smell sense — The nose

   d. Taste sense — The tongue

   e. Touch and pain sense — The skin and internal organs

4. **Layers (coats) of the eyeball** (Figure 3)

   a. Outer layer — Sclera

      (1) Tough, white fibrous, protective layer

      (2) Anterior portion is known as the cornea.

         (a) Lies over the colored part (iris) of the eye
         (b) Cornea is transparent.
         (c) Cornea contains no blood vessels.

      (3) The remainder of the sclera is white, and is commonly known as the "white of the eye."

   b. Middle layer — Choroid coat

      (1) Contains the blood vessels that supply the eye

      (2) Anterior portion is modified into three separate structures.

         (a) Iris — The colored part of the eye, shaped like a doughnut, which attaches to the ciliary body

         Note: The opening in the middle is called the pupil.

         (b) Ciliary body — A muscular ring that alters the shape of the iris
         (c) Suspensory ligament — The structure that holds the lens in place

Information Sheet

c. Inner layer — Retina

(1) "The camera of the eye" — Receives image formed by the lens

(2) Innermost, incomplete coat of the eyeball which is found only in the posterior part of the eyeball (has no anterior portion)

(3) Consists of specialized nerve tissue for the reception of light

(4) Structure upon which light rays come to a focus

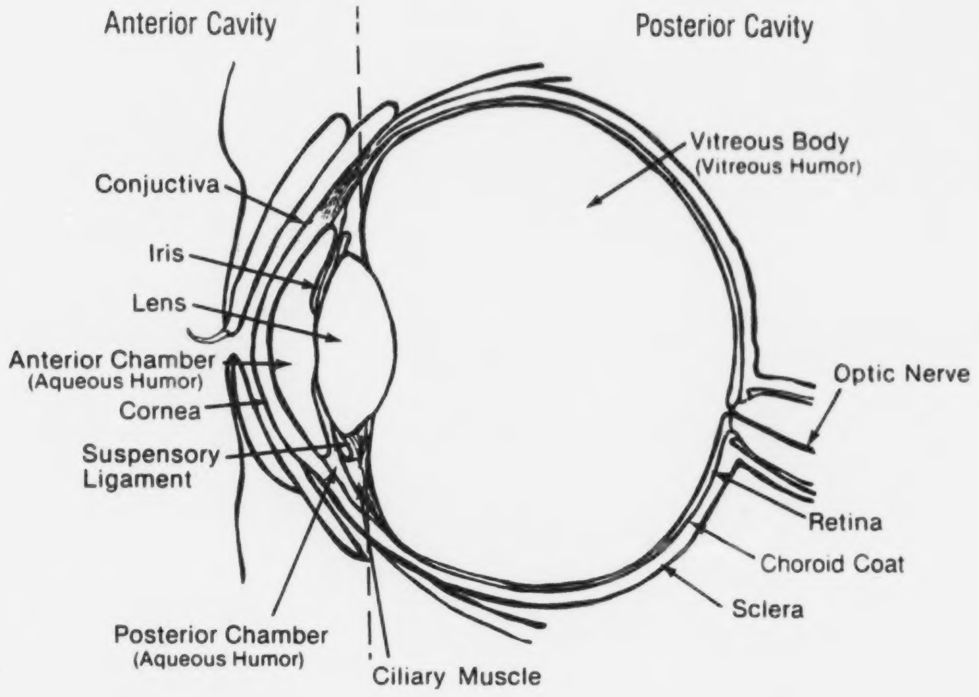
(5) Contains tiny receptors — rods and cones — for vision

(6) The pathway which conducts impulses from the receptors to the brain is the optic nerve.

   (a) The location where the optic nerve leaves the eyeball is known as the optic disk or "blind spot."

   (b) There are no receptors (rods and cones) located in the blind spot; therefore, light rays striking this area cannot be seen.

Figure 3


Anterior Cavity
Posterior Cavity
Vitreous Body
(Vitreous Humor)
Conjuctiva
Iris
Lens
Anterior Chamber
(Aqueous Humor)
Cornea
Suspensory Ligament
Optic Nerve
Retina
Choroid Coat
Sclera
Posterior Chamber
(Aqueous Humor)
Ciliary Muscle

Information Sheet

5. **Humors of the eyeball** (Figure 3)

   a. **Aqueous humor** — Watery, transparent liquid that circulates through the anterior cavity of the eye

   b. **Vitreous humor** — Clear, jelly-like fluid in the posterior cavity of the eye which fills the vitreous body

6. **Extrinsic and intrinsic eye muscles** (Figure 4)

   a. **Extrinsic eye muscles** — Those that attach to the outside of the eyeball and to the bones of the orbit

      (1) Are voluntary muscles that move the eyeball in any desired direction

      (2) Four are straight muscles.

         (a) Superior rectus
         (b) Inferior rectus
         (c) Medial rectus
         (d) Lateral rectus

      (3) Two are oblique muscles.

         (a) Superior oblique
         (b) Inferior oblique

      (4) The same muscle in each eye allows the individual to use both eyes to focus on the same field.

   b. **Intrinsic eye muscles** — Those that are located inside the eyeball itself

      (1) Consist of two involuntary muscles

      (2) Iris

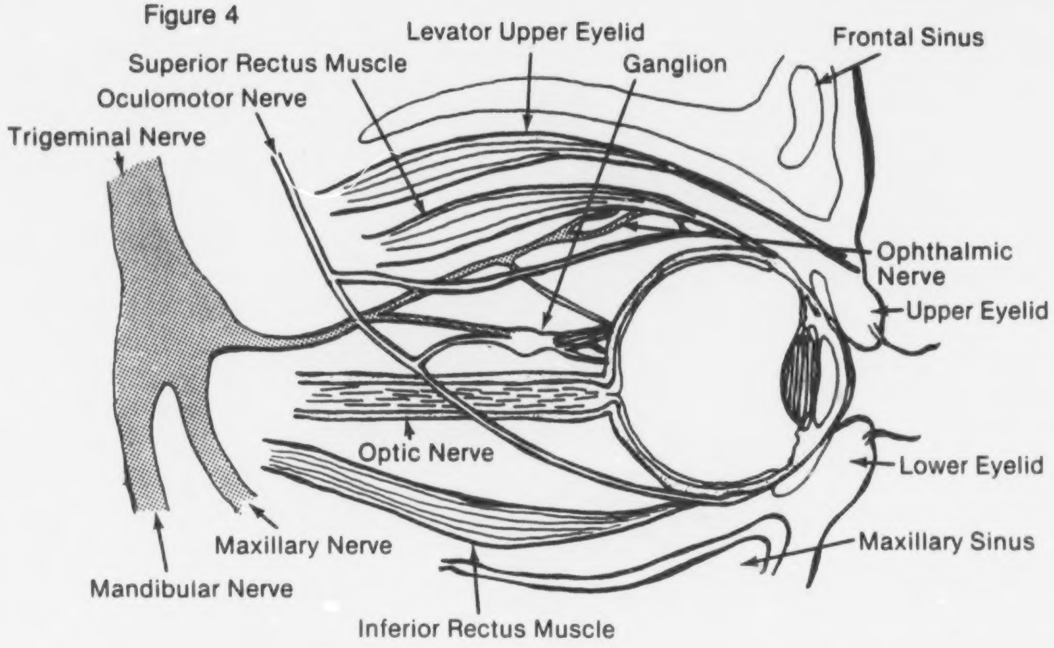
         (a) Is a doughnut-shaped sphincter muscle resembling the spokes of a wheel
         (b) Regulates the size of the pupil and therefore the amount of light entering the eye

      (3) Ciliary body

         (a) Is a flattened ring the size of the iris
         (b) Alters the shape of the iris
         (c) Changes the focus of the lens and adjusts the eye for distant and close-up vision

Information Sheet

Figure 4


Levator Upper Eyelid
Frontal Sinus
Superior Rectus Muscle
Ganglion
Oculomotor Nerve
Trigeminal Nerve
Ophthalmic Nerve
Upper Eyelid
Optic Nerve
Lower Eyelid
Maxillary Nerve
Maxillary Sinus
Mandibular Nerve
Inferior Rectus Muscle

7. **Accessory structures of the eye** (Figure 4)

   a. **Eyebrows and eyelashes**

      (1) Give protection against foreign objects entering the eye

      (2) Small glands at the base of the eyelashes also secrete a lubricating fluid.

   b. **Eyelids** (palpebrae)

      (1) Are located in front of the eyeball

      (2) Blink as a result of sensory stimuli to keep out foreign objects

      (3) Consist of voluntary muscle and skin

      (4) Are lined with mucous membrane called conjunctiva

         (a) Conjunctiva is transparent and is continuous over the surface of the eyeball.

         (b) Can become inflamed and result in conjunctivitis (pink eye)

Information Sheet

(5) The opening between the eyelids is called the palpebral fissure.

(6) The angles of the ends of the eyelids are known as the inner and outer canthus.

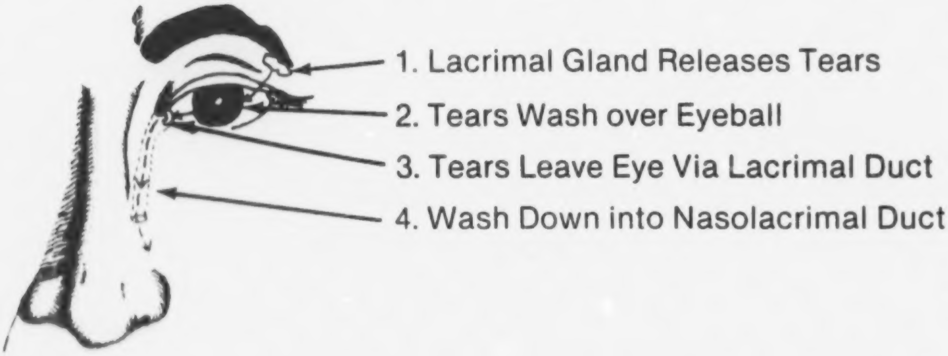
c. **Lacrimal glands and ducts** (Figure 5)

(1) Secrete tears which keep the anterior surface of the eye moist and free from irritating particles

(2) Lacrimal glands are the size of small almonds and are located in the upper, outer portion of each orbit.

(3) Nasolacrimal ducts are small tubes extending from the lacrimal sacs into the nose to drain tears from the eye into the nose.

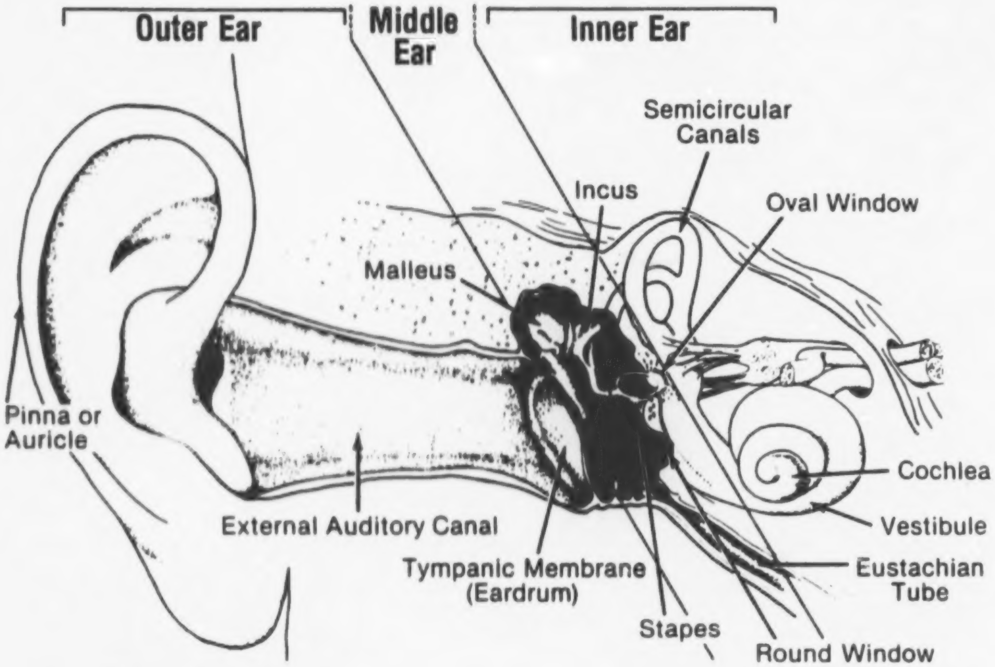
Figure 5


1. Lacrimal Gland Releases Tears
2. Tears Wash over Eyeball
3. Tears Leave Eye Via Lacrimal Duct
4. Wash Down into Nasolacrimal Duct

Information Sheet

8. **Parts of the ear** (Figure 6)

Figure 6


Outer Ear
Middle Ear
Inner Ear
Semicircular Canals
Incus
Oval Window
Malleus
Pinna or Auricle
Cochlea
External Auditory Canal
Vestibule
Tympanic Membrane (Eardrum)
Eustachian Tube
Stapes
Round Window

a. **External ear**

(1) Divided into two main parts

(a) Pinna (auricle) — The outer, extended portion on the side of the head composed of cartilage and covered with skin
(b) External auditory canal — A canal about one inch in length which contains ceruminous glands in its walls and ends at the tympanic membrane

(2) Tympanic membrane (eardrum) — Stretches across the end of the auditory canal and separates the external ear from the middle ear

Information Sheet

b. **Middle ear** (Tympanic cavity)

(1) A small air cavity located in the temporal bone

(2) Contains three ossicles which extend from the tympanic membrane to the oval window

- (a) Malleus (hammer) — Attached to tympanic membrane
- (b) Incus (anvil) — Attached to the head of the malleus
- (c) Stapes (stirrup) — Fits in the oval window

(3) Has several openings

- (a) External auditory meatus — Covered by the tympanic membrane
- (b) Oval window into the internal ear — The stapes fits into it
- (c) Round window into the internal ear — Covered by a membrane
- (d) Eustachian tube — Connects the middle ear with the nasopharynx which allows equalization of air pressure on both sides of the eardrum

(4) Posteriorly, the middle ear is continuous with mastoid air spaces in the temporal bone.

(5) Middle ear functions to allow transmission of sound by the vibrations of the ossicles.

c. **Internal ear** (labyrinth)

(1) Contains essential organs for hearing and equilibrium

(2) Contains bony labyrinth — A series of canals in the temporal bone; consists of three parts

(a) Cochlea

- 1) Resembles the shape of a snail
- 2) Is filled with fluid (perilymph)
- 3) Contains receptors for hearing
- 4) Organ of Corti is the hearing sense organ which rests throughout the length of the cochlear duct, and sends sensations to the cochlear nerve, a division of the eighth cranial nerve.

Information Sheet

(b) Semi-circular canals

1) Three canals placed at right angles to each other
2) Are filled with fluid
3) Contain receptors for equilibrium
4) Movements of the head agitate the fluid which stimulates the receptors which send impulses concerning equilibrium through the acoustic nerve to the brain.

(c) Vestibule

1) Occupies the space between the cochlea and semi-circular canals
2) Is concerned with equilibrium

(3) Contains membranous labyrinth

(a) Lies within the bony labyrinth
(b) Is filled with fluid (endolymph)
(c) Contains receptors for equilibrium, sense of position, sense of head movements, and hearing

(4) Sends equilibrium and hearing sensations to the acoustic (auditory) nerve

(a) Acoustic nerve has two parts.

1) Vestibular for equilibrium
2) Cochlear for hearing

(b) Acoustic nerve carries impulses from inner ear to the brain.

9. Types of conduction used in the process of hearing

a. **Air conduction**

(1) Occurs in the external ear

(2) Sound waves come through the external auditory meatus and set the tympanic membrane in vibration.

b. **Bone conduction**

(1) Occurs in the middle ear

(2) The chain of ossicles transmits the vibration of the tympanic membrane to the inner ear.

Information Sheet

c. **Fluid conduction**

(1) Occurs in the inner ear

(2) Vibration of the ossicles set the fluid system into motion.

(3) Movement of the fluid in the cochlea stimulates the receptors for hearing (Organ of Corti).

(4) The receptors set up impulses which are conveyed by the acoustic nerve to the brain where sound is perceived.

10. **The sense of smell** (Figure 7)

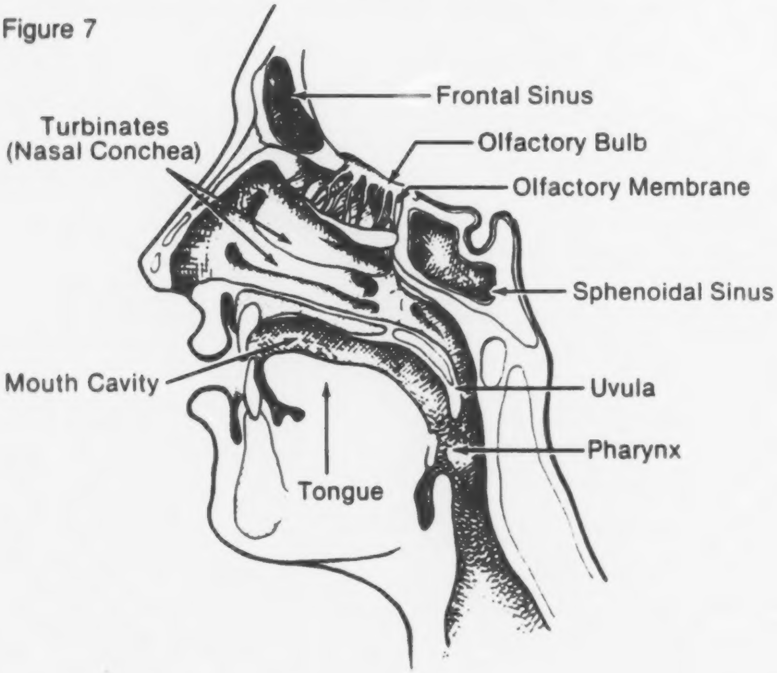
a. Also called the olfactory sense

b. The receptors for smell are the least specialized of the special senses.

c. The receptors for the olfactory (first) cranial nerve lie in the mucosa of the upper part of the nasal cavity.

d. Adaptation to odors is very rapid, and the receptors are easily fatigued, which explains why odors are not sensed at all after a short time.

Figure 7

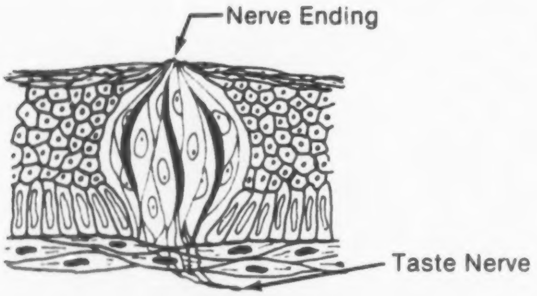

Frontal Sinus
Turbinates (Nasal Conchea)
Olfactory Bulb
Olfactory Membrane
Sphenoidal Sinus
Mouth Cavity
Uvula
Pharynx
Tongue

11. The sense of taste

a. Also called the gustatory sense

b. The receptors for taste are the taste buds which are located in the papillae (elevations of the mucous membrane) of the tongue.

Figure 8—Enlarged view of a taste bud



c. The sense of taste is limited to four fundamental taste sensations localized to four kinds of taste buds.

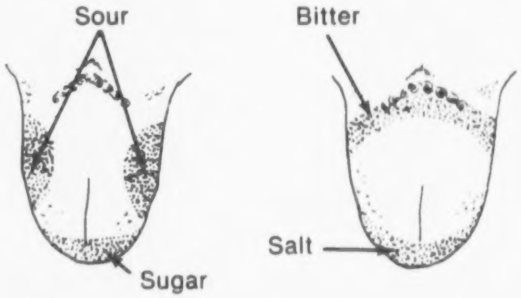
(1) Salty — Localized near the tip of the tongue

(2) Sweet — Localized near the tip of the tongue

(3) Sour — Localized along the sides of the tongue

(4) Bitter — Localized at the back of the tongue

Figure 9



d. Receptors for taste come from branches of the seventh and ninth cranial nerves.

Note: Many foods that we think we taste are actually only smelled.

Information Sheet

12. The sense of touch and pain

a. Touch is sensed by receptors of sensory dendrites which are located in the skin.

b. There are specific kinds of receptors which are sensitive to specific kinds of stimuli.

c. Pain receptors, also called nociceptors, give warning of potentially harmful environmental changes.

d. Nociceptors are located in the skin and in the viscera.

e. Pain receptors are classified according to location.

   (1) Somatic pain which may be superficial or deep

   (2) Visceral pain from the internal organs

f. Referred pain

   (1) The cerebrum does not always interpret the location of pain accurately.

   (2) Sometimes it refers pain to a surface area instead of the region from which it came. This is know as referred pain.

   (3) Referred pain only occurs from stimulation of deep structures (muscles, fascia, joints, and tendons) or viscera.

   (4) Pain from the skin is never referred.

Special Sense Organs
Unit 7

Student Supplement 1—Identify the Parts of the Ear

Name ______________________________

Directions: Identify the parts of the ear in the following illustration. Place your answers in the blanks provided.

a. ____________________ i. ____________________

b. ____________________ j. ____________________

c. ____________________ k. ____________________

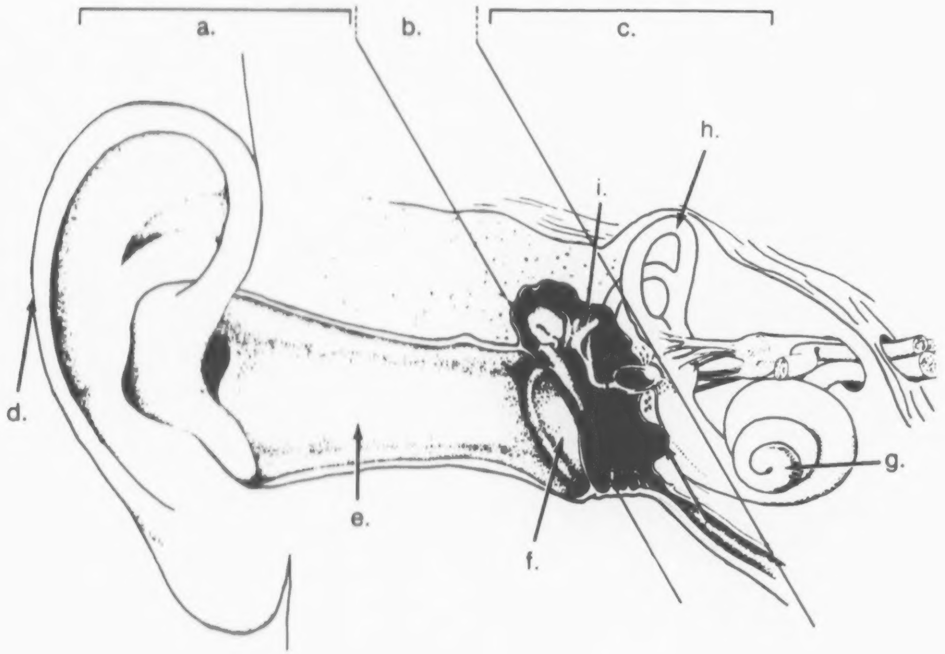
d. ____________________ l. ____________________

e. ____________________ m. ____________________

f. ____________________ n. ____________________

g. ____________________ o. ____________________

h. ____________________



Special Sense Organs
Unit 7

Student Supplement 2—Complete Statements Concerning the Special Sense Organs

Name ______________________________

Directions: Complete the following statements by placing the correct answers in the blanks provided.

______ 1. The structure that brings air into the middle ear equalizing the pressure on both sides of the eardrum is most commonly called the

a. Auditory meatus
b. Eustachian tube
c. Mastoid process
d. External auditory canal

______ 2. The outermost layer of the eye that is commonly called the "white of the eye" is the

a. Cornea
b. Choroid
c. Retina
d. Sclera

______ 3. Tears are produced by the

a. Lacrimal glands
b. Cowpers glands
c. Optic glands
d. Skenes glands

______ 4. An inflammation of the conjunctiva involves the

a. Circular muscle around the pupil
b. Optic nerve
c. Membrane covering the front of the eye
d. Glands that produce tears

______ 5. The bones of the middle ear serve to amplify sound waves and transmit them to the

a. Oval window
b. Round window
c. Tympanic membrane
d. Eustachian tube

Student Supplement 2

______ 6. The purpose of the iris is to

- a. Act as a lens
- b. Add color to vision
- c. Refract or bend light
- d. Regulate the amount of light entering the eye

______ 7. The innermost layer of the eyeball contains the organs for the sense of vision and is called the

- a. Retina
- b. Sclera
- c. Cornea
- d. Choroid coat

______ 8. The colored or pigmented part of the eye is called the

- a. Ciliary body
- b. Pupil
- c. Iris
- d. Lens

______ 9. The passageway or tube which connects the middle ear to the nasopharynx is the

- a. Auditory canal
- b. Esophagus
- c. Oval tube
- d. Eustachian tube

______10. The sensory nerve which allows us to hear is the

- a. Oculomotor nerve
- b. Abducens nerve
- c. Olfactory nerve
- d. Acoustic nerve

______11. The external ear is sometimes known as the

- a. Utricle
- b. Pinna
- c. Vestibule
- d. Cochlea

Student Supplement 2

______12. The sensory cells for the sense of smell are known as

a. Olfactory
b. Oculomotor
c. Optic
d. Epithelial

______13. The sense of taste is limited to how many fundamental tastes?

a. Six
b. Three
c. Two
d. Four

______14. The physiology of hearing is composed of air, bone, and fluid conduction. Air conduction occurs in the external ear and is described as

a. The movement of perilymph
b. The movement of endolymph
c. The vibration of the ossicles
d. Sound waves vibrating the eardrum

______15. The inner ear contains the essential organs for hearing and equilibrium. The structure which contains the receptors for hearing is the

a. Semi-circular canals
b. Cochlea
c. Vestibule
d. Fenestra ovalis

______16. The structure in the inner ear which contains the receptors for equilibrium is the

a. Organ of Corti
b. Stapes
c. Cochlea
d. Semi-circular canals

______17. The middle and inner ear are brought into contact with each other by the

a. Tympanic membrane
b. Eustachian tube
c. Round and oval windows
d. Incus

Student Supplement 2

______18. The root word which refers to the ear is

a. Oto-
b. Ophthalmo-
c. Oophoro-
d. Osteo-

______19. The ear is divided into how many parts?

a. Four
b. Three
c. One
d. Two

______20. The external auditory canal is about one inch in length and extends from the pinna to the

a. Tympanic membrane
b. Stapes
c. Eustachian tube
d. Incus

______21. The outer layer of tissue of the eyeball is the

a. Sclera
b. Retina
c. Cornea
d. Choroid coat

______22. What is the function of the intrinsic eye muscles?

a. Adjust the lens and iris
b. Hold the eyeball in place
c. Allow the eyeball to move up and down
d. Allow the eyeball to move obliquely

______23. Another name for lacrimal glands is

a. Salivary glands
b. Retinal glands
c. Sweat glands
d. Tear glands

______24. The camera of the eye is the

a. Sclera
b. Choroid
c. Retina
d. Conjunctiva

Student Supplement 2

______25. The middle ear is a small bony cavity located in the temporal bone and contains three small movable bones known as the

a. Malleus, incus, patella
b. Incus, patella, coccyx
c. Stapes, incus, malleus
d. Stapes, carpal, ovalis

______26. What is present in the external auditory canal for protection of the ear?

a. Ceruminous glands
b. Lymph glands
c. Sweat glands
d. Ear bones

______27. The mucous membrane which lines the inner surface of the eyelids and covers the front portion of the eyeball is know as the

a. Retina
b. Sclera
c. Choroid
d. Conjunctiva

______28. The function of the retina is

a. Regulation of pressure in the anterior chamber or cavity
b. Reception and transmission of images to the cerebrum
c. Regulation of pressure in the posterior chamber
d. Reception of images in bright light only

______29. The root word which refers to the eye is

a. Oto-
b. Ophthalmo-
c. Oophoro-
d. Osteo-

______30. Bone conduction occurs in the middle ear and is described as

a. The vibration of the ossicles from sound waves vibrating the eardrum
b. Movement of endolymph and perilymph
c. Vibration of mastoid cells
d. Vibration of the temporal bone

Student Supplement 2

______31. The name of the nerve which carries sight impulses to the brain is the

a. Trochlear nerve
b. Trigeminal nerve
c. Oculomotor nerve
d. Optic nerve

______32. The sense of touch is accomplished by what structure found in the skin?

a. Epithelial cells
b. Receptors
c. Sebaceous glands
d. Effectors

______33. Visceral pain results from stimulation of nerve fibers located where?

a. Brain
b. Skin
c. Bones, joints, and tendons
d. Organs

______34. Why are an individual's taste sensations dulled when he/she has a cold?

a. Because mucous covers the taste buds
b. Because the virus attacks the taste buds
c. Because the cold interferes with the olfactory receptors
d. Because one does not eat when one has a cold

Digestive System
Unit 8

Objective sheet

Unit Objective

After completing this unit, the student should be able to identify organs of the digestive system and their parts and complete statements concerning the functions and characteristics of these organs. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the digestive system with their correct definitions.
2. Complete statements concerning the alimentary canal.
3. Identify organs which form the alimentary canal.
4. List functions of the digestive system.
5. Complete statements concerning the anatomy of the abdominopelvic cavity.
6. Select functions of the peritoneum.
7. Match the coats composing the walls of the alimentary canal with the correct descriptions.
8. Match the organs of the alimentary canal with the correct functions.
9. Select true statements concerning the mouth.
10. Match types of teeth with the correct adaptations.
11. Identify the three portions of a tooth.
12. Match the salivary glands with the correct descriptions.
13. Complete statements concerning the pharynx.
14. Select true statements concerning the esophagus.
15. Select true statements concerning the stomach.

Objective Sheet

16. Distinguish between the openings of the stomach.
17. Identify the curvatures of the stomach.
18. Identify the parts of the stomach.
19. Select true statements concerning the blood and nerve supply to the stomach.
20. Distinguish between characteristics of the small and large intestines.
21. Match the portions of the small intestine with the correct characteristics.
22. Complete statements concerning the divisions of the large intestine.
23. Identify the sections and flexures of the colon.
24. Select true statements concerning the blood supply to the large intestine.
25. Complete statements concerning the liver.
26. Select the functions of the liver.
27. Complete statements concerning the ducts of the liver.
28. Select the ligaments of the liver.
29. Select the lobes of the liver.
30. Complete statements concerning the blood supply to the liver.
31. Complete statements concerning the gallbladder.
32. Complete statements concerning the pancreas.

Digestive System
Unit 8

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—The Digestive Organs (Objective 3)
   TM 2—Deciduous and Permanent Teeth (Objectives 9 and 10)
   TM 3—Structure of a Molar (Objective 11)
   TM 4—The Salivary Glands (Objective 12)
   TM 5—Parts of the Stomach (Objective 18)
   TM 6—Structure of the Villi (Objective 20)
   TM 7—Parts of the Large Intestine (Objectives 20, 22, and 23)
   TM 8—The Liver, Gallbladder, and Pancreas (Objectives 25, 27, 31, and 32)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Review with students the quadrants and regions of the abdomen which were covered in "Organization of the Body," Unit 1. These will be used to locate the organs discussed in this unit.

2. Discuss the anatomy of the digestive system using other illustrations, wall charts, or models available in the classroom.

3. Discuss diseases and conditions which affect the digestive organs such as ulcers, pyloric stenosis, and biliary atresia.

4. Show films available concerning the digestive system.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.

2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.

3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.

4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Videotapes

   a. *I Am Joe's Stomach*

   b. *I Am Joe's Liver*

   a-b are part of the *I Am Joe's* Series available from several sources. Two companies offering this series include the following:

   (1) Medcom/Trainex
   Box 3225
   Garden Grove, CA 92641
   800-877-1443

   (2) Pyramid Film and Video
   P.O. Box 1048
   Santa Monica, CA 90406-1048
   800-421-2304

   c. *Eating to Live*

   d. *Breakdown*

   c-d are part of *The Living Body* Series available from:

   Films for the Humanities and Sciences
   P.O. Box 2053
   Princeton, NJ 08543-2053
   800-257-5126 or 609-452-1128

   e. *Digestive System*, second edition, part of the *Human Body Series*

   f. *Digestion and Absorption*, part of *Your Active Body Series*

   e-f are available from:

   Coronet Films
   108 Wilmot Road
   Deerfield, IL 60015-5196
   800-777-8100

Suggested Activities

2. Audiotape—*Digestive System*, part of the *Medical Terminology Made Easy* Series of audiotapes available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

3. Software program—*The Gastrointestinal System* (Module 6), part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

4. Anatomy charts and models on the digestive system are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
   P.O. Box 21207
   Waco, TX 76702-1207
   800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
   3823 Leavenworth Street
   Omaha, NB 68105
   800-228-7117

Digestive System
Unit 8

Answers to Student Supplements

Student Supplement 1

a. Salivary glands
b. Pharynx
c. Esophagus
d. Liver
e. Gallbladder
f. Large intestine
g. Mouth
h. Stomach
i. Pancreas
j. Small intestine

Student Supplement 2

a. Pylorus
b. Pyloric sphincter
c. Lesser curvature
d. Cardiac sphincter
e. Fundus
f. Body
g. Greater curvature

Student Supplement 3

a. Transverse colon
b. Hepatic flexure
c. Ascending colon
d. Cecum
e. Appendix
f. Splenic flexure
g. Descending colon
h. Sigmoid colon
i. Rectum
j. Anal canal

Answers to Student Supplements

Student Supplement 4

1. a
2. d
3. d
4. d
5. c
6. d
7. b
8. b
9. a
10. d
11. d
12. b
13. a
14. b
15. b
16. a
17. b
18. d
19. b
20. c
21. d
22. a
23. c
24. c
25. a
26. a
27. a
28. d
29. c
30. b
31. d
32. b
33. a
34. b
35. b
36. d
37. c
38. c
39. b
40. b
41. d
42. d
43. c
44. a
45. d
46. d
47. d
48. a
49. d
50. b

Digestive System
Unit 8

Answers to Written Test

1. a. 1
   b. 11
   c. 18
   d. 19
   e. 16
   f. 14
   g. 23
   h. 8
   i. 7
   j. 10
   k. 5
   l. 4
   m. 9
   n. 17
   o. 24
   p. 22
   q. 20
   r. 15
   s. 3
   t. 2

2. a. 32
   b. Anus
   c. Ventral
   d. Gastrointestinal

3. a. Salivary glands
   b. Pharynx
   c. Esophagus
   d. Liver
   e. Gallbladder
   f. Large intestine
   g. Mouth
   h. Stomach
   i. Pancreas
   j. Small intestine

4. Any two of the following:

   a. Breaks down food in preparation of absorption by the body
   b. Absorbs the broken down food
   c. Discharges wastes resulting from digestion using large intestine

5. a. Ventral
   b. Peritoneum
   c. Posterior
      (1) Small
      (2) 20
   d. Visceral
   e. Peritoneal cavity
   f. Greater
      (1) Duodenum
      (2) Walling off
   g. Lesser

Answers to Written Test

6. b, c, e, g

7. a. 2
   b. 4
   c. 1
   d. 3

8. a. 7
   b. 4
   c. 3
   d. 8
   e. 12
   f. 9
   g. 11
   h. 5
   i. 10
   j. 2

9. b, f

10. a. Crown
    b. Neck
    c. Root

11. a. 3
    b. 2
    c. 4
    d. 1

12. a. 1
    b. 3
    c. 2

13. a. Esophagus
    b. (1) Nasopharynx
       (2) Oropharynx
       (3) Laryngopharynx

14. d, e, f

15. b, d

16. a

17. a. Lesser curvature
    b. Greater curvature

Answers to Written Test

18. a. Pylorus
    b. Body
    c. Fundus

19. b, d, e

20. a. L
    b. S
    c. S
    d. L
    e. S
    f. L
    g. S

21. a. 1
    b. 2
    c. 3
    d. 3
    e. 2
    f. 2
    g. 3
    h. 1
    i. 3

22. a. 2
    b. 1
    c. 4
    d. 4
    e. 2
    f. 1
    g. 3

23. a. Transverse colon
    b. Hepatic or right colic flexure
    c. Ascending colon
    d. Splenic or left colic flexure
    e. Descending colon
    f. Sigmoid colon

24. a, b, c

25. a. Largest
    b. Glisson's
    c. First
    d. Under
    e. Under
    f. Pyloric

26. a, d, e, f, g, i, k

27. a. Hepatic
    b. Cystic, common bile
    c. Ampulla or papilla of Vater
    d. Pyloric

Answers to Written Test

28. a, b, d, f

29. b, c, e, f

30. a. Portal
    b. Aorta
    c. Portal, stomach
    d. Inferior

31. a. Pear
    b. 3 to 4 inches
    c. Three
    d. Duodenum

32. a. Behind
    b. Three
    c. Spleen
    d. Ounces
    e. Pancreatic
    f. Common bile
    g. Insulin

Digestive System
Unit 8

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

_____a. Pertaining to nutrition

_____b. The branch of medical science dealing with the physiology and pathology of the stomach, intestines, and related structures such as liver, gallbladder, and pancreas

_____c. The serous membrane reflected over the viscera and lining the abdominal cavity

_____d. Inflammation of the peritoneum

_____e. A peritoneal fold encircling the greater part of the small intestine and connecting the intestine to the posterior abdominal wall

_____f. Chewing

_____g. Inflammation of the mouth

_____h. Constricted opening leading from the mouth bound by the soft palate, base of tongue, and the palatine arches

_____i. Complex protein which is capable of inducing a chemical change in another substance

_____j. Inflammation of the stomach

_____k. The process by which food is broken down, mechanically and chemically, in the gastrointestinal tract and is converted into absorbable forms

_____l. The thick, nearly liquid mixture of partly digested food and digestive secretions found in the stomach and small intestine during digestion

1. Alimentary
2. Atresia
3. Bile
4. Chyme
5. Digestion
6. Diverticulum
7. Enzyme
8. Fauces
9. Flatus
10. Gastritis
11. Gastroenterology
12. Gingivitis
13. Hydrochloric acid
14. Mastication
15. Meckel's diverticulum
16. Mesentery
17. Peristalsis
18. Peritoneum

Written Test

_______m. Gas in digestive tract

_______n. A progressive, wave-like movement that occurs involuntarily in hollow tubes of the body, especially the alimentary canal, to force the contents of the tube onward

_______o. An open sore or lesion of the skin or a mucous membrane

_______p. Folds of mucous membrane seen on internal surface of stomach

_______q. Abnormal narrowing or stricture of the pylorus

_______r. A diverticulum of the ileum about three feet above the ileocecal junction

_______s. A yellow or greenish viscid alkaline fluid secreted by the liver which aids in the digestion and absorption of fats

_______t. Imperforation or closure of a normal tubular opening of the body

19. Peritonitis
20. Pyloric stenosis
21. Pylorospasm
22. Rugae
23. Stomatitis
24. Ulcer

2. Complete the following statements concerning the alimentary canal by circling the correct answers.

   a. The alimentary canal is approximately (12, 32) feet in length.

   b. The alimentary canal extends in one long tube from the mouth to the (stomach, anus).

   c. The alimentary canal lies in the (dorsal, ventral) cavity of the body.

   d. The alimentary canal is also referred to as the (upper gastric, gastrointestinal) tract.

Written Test

3. Identify the organs which form the alimentary canal and place your answers in the blanks provided.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

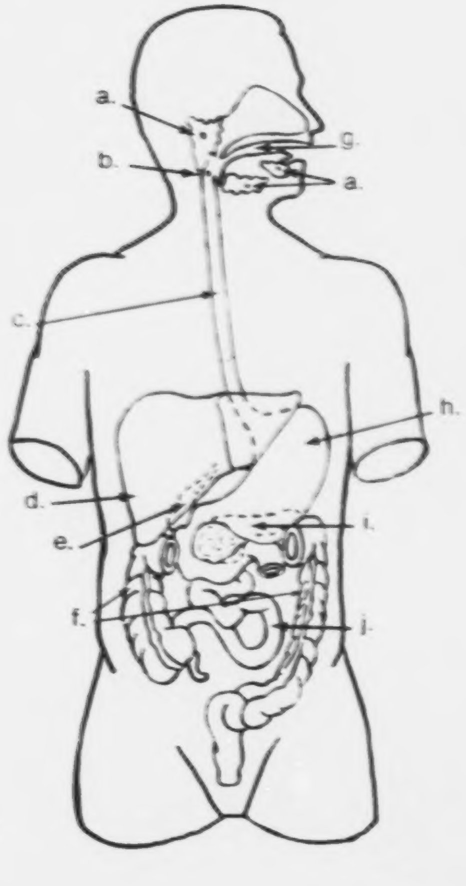
f. ____________________

g. ____________________

h. ____________________

i. ____________________

j. ____________________



Written Test

4. List two functions of the digestive system.

   a. ______________________________

   b. ______________________________

5. Complete the following statements concerning the anatomy of the abdominopelvic cavity by filling in the blanks with the correct answers.

   a. The abdominopelvic cavity is the division of the ________________ cavity lying inferior to the diaphragm.

   b. The cavity is lined and its organs are covered with a membrane known as ________________.

   c. The ________________ walls of the abdominal cavity are lined with the parietal peritoneum.

      (1) Most of the ________________ intestine is attached to its outer edge which is known as mesentery.

      (2) The mesentery's outer edge is ________________ feet wide, and the posterior edge is 6 to 8 inches wide.

   d. The abdominal organs and upper surface of some of the pelvic organs are covered by the ________________ peritoneum.

   e. The space between the parietal and visceral peritoneum is the ________________.

   f. The ________________ omentum is a fatty, apron-shaped, double-fold of peritoneum.

      (1) It is attached at its upper border to the ________________ and lower edge of the stomach and transverse colon.

      (2) It gives warmth, protection, and aids in ________________ localized inflammation in the abdomen when peritonitis is present.

   g. The ________________ omentum connects the lesser curvature of the stomach with the left lobe of the liver.

Written Test

6. Select functions of the peritoneum by placing an "X" next to the correct functions.

______a. Separates abdominal organs

______b. Unites abdominal organs

______c. Separates pelvic organs

______d. Unites pelvic organs

______e. Holds the abdominal and pelvic organs in position

______f. Holds the heart in position

______g. Prevents friction between contiguous organs by secreting serum which acts as a lubricant

7. Match the coats composing the walls of the alimentary canal on the right with the correct descriptions.

______a. Innermost layer that lines the organs and contains glands

______b. Contains blood vessels, lymphatics, and nerves

______c. Consists of non-striated muscular tissue

______d. Outermost coat which covers all parts except the posterior wall of some organs

1. Muscular coat
2. Mucosa
3. Serous coat
4. Submucosa

8. Match the organs of the alimentary canal on the right with the correct functions.

______a. To connect esophagus to small intestine, to secrete gastric juices which aid in digestion of food, and to serve as a temporary receptacle for food while it undergoes certain mechanical and chemical processes which change food to chyme

______b. For the greatest amount of digestion and absorption of food, to receive bile and pancreatic juices, and to produce prosecretin which stimulates the associated digestive organs to produce their secretions

1. Teeth
2. Liver
3. Large intestine
4. Small intestine
5. Salivary glands
6. Gallbladder

Written Test

______c. To reabsorb water and to discharge the wastes resulting from digestion

______d. To begin the breakdown of food physically and chemically, and to move food on to the pharynx

______e. To act as passageway for air from nasal cavity to larynx and for food from mouth to esophagus, and to act as a resonating cavity for voice production

______f. To act as a passageway for food from pharynx to stomach

______g. To make speech possible, to taste food, to force food between teeth, and to move food through mouth

______h. To secrete saliva which lubricates food making it easier to chew and swallow which contains digestive juices to act upon carbohydrates and soften food

______i. Has various special cells which produce pancreatic juice and insulin

______j. Produces bile, stores glycogen, regulates the changing of glucose to glycogen and glycogen to glucose, stores iron and certain vitamins (fat-soluble), and changes protein into substances (urea) for elimination

7. Stomach
8. Mouth
9. Esophagus
10. Pancreas
11. Tongue
12. Pharynx

9. Select true statements concerning the mouth by placing an "X" in the appropriate blanks.

______a. Is a nearly ball-shaped cavity

______b. Roof of mouth is formed by the hard and soft palate.

______c. Most of the floor of the mouth is formed by the salivary glands.

______d. Contains teeth which are set in sockets called olecranon

______e. The gums are called alveoli.

______f. The gums are called gingiva.

______g. Three sets of teeth develop during life.

______h. There are normally 20 permanent teeth.

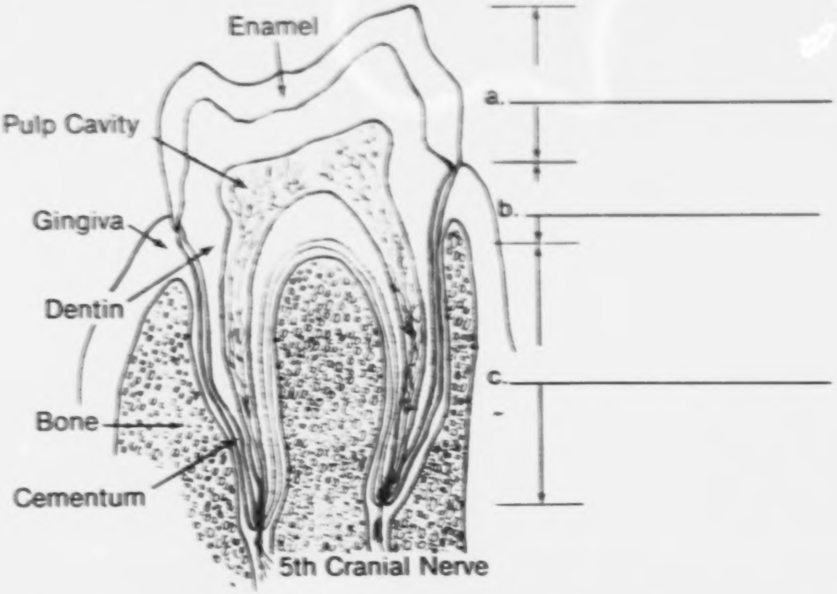
Written Test

10. Match types of teeth on the right with the correct adaptations.

______a. Adapted for biting food
______b. Adapted for biting and tearing food
______c. Adapted for grinding food
______d. Adapted for crushing food

1. Tricuspids (molars)
2. Cuspids
3. Incisors
4. Bicuspids

11. Identify the three portions of a tooth and place your answers in the blanks provided.



12. Match the salivary glands on the right with the correct descriptions.

______a. Glands located in the posterior part of the floor of the mouth; secrete primarily serous fluid with some mucus
______b. Glands located in the anterior part of the floor of the mouth; secrete primarily thick mucus
______c. Largest glands located under and in front of each ear; secrete clear, watery serous fluid and an enzyme called amylase

1. Submandibular
2. Parotid
3. Sublingual

Written Test

13. Complete the following statements concerning the pharynx by filling in the blanks with the correct answers.

    a. Is a musculo-membrane tube that extends from the back of the throat to the beginning of the __________________.

    b. Is divided into three parts:

        (1) __________________ — Located in the superior portion of the throat behind the nasal cavity above the palate

        (2) __________________ — Located in the midportion of the throat behind the mouth between the palate and the hyoid bone

        (3) __________________ — Located in the inferior portion of the throat just above the larynx and below the hyoid bone

14. Select true statements concerning the esophagus by placing an "X" next to the true statements.

    ______a. Is a mucous tube about 15 inches long, which begins at the lower end of the pharynx and ends in the upper portion of the larynx

    ______b. Has a peritoneal coat as it lies in the abdominal cavity

    ______c. Lies anterior to the heart and trachea

    ______d. Goes through the esophageal hiatus in the diaphragm in its descent from the thoracic to the abdominal cavity

    ______e. Walls of the esophagus are composed of four layers.

    ______f. Food is propelled into the stomach by peristaltic contractions.

15. Select true statements concerning the stomach by placing an "X" next to the true statements.

    ______a. Is an elongated pouch lying obliquely in the left upper quadrant in the epigastric, umbilical, and left inguinal regions

    ______b. Sizes varies with sex and other factors.

    ______c. Can hold up to a gallon of food until it is ready to be received into the small intestine

    ______d. Dilates according to amount of food ingested

    ______e. When not distended, the mucous coat lies in folds known as muscle.

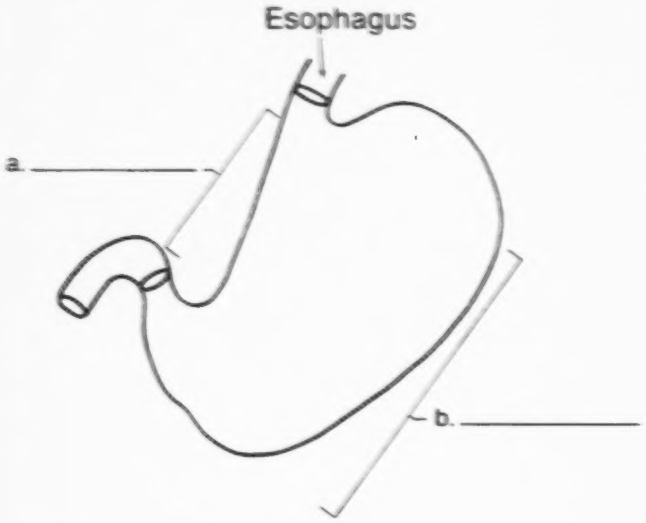
Written Test

16. Distinguish between the openings of the stomach by placing an "X" next to the description of the pyloric opening.

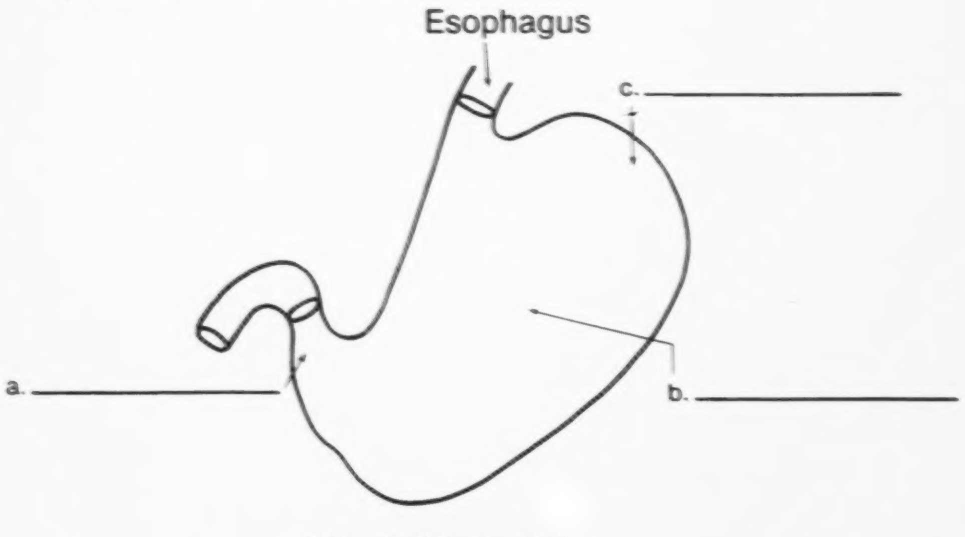
_____a. Located at the lower end of the stomach where the stomach joins the small intestine

_____b. Located at the upper end of the stomach where the esophagus joins the stomach

17. Identify the curvatures of the stomach.



18. Identify the parts of the stomach.



Written Test

19. Select true statements concerning the blood and nerve supply to the stomach by placing an "X" next to the true statements.

______a. Blood supply comes from the vagus artery.

______b. Blood supply comes from the gastric artery.

______c. Blood returns via the iliac vein.

______d. Gastric veins unite with the superior mesenteric vein which empties into the portal vein.

______e. Right vagus nerve supplies the dorsal side of the stomach.

______f. Left vagus nerve supplies the dorsal side of the stomach.

20. Distinguish between characteristics of the small and large intestines by placing an "S" next to the characteristics of the small intestine and an "L" next to those of the large intestine.

______a. Consists of a tube about 2½ inches in diameter which decreases in size toward the end of the tube, and is approximately 5 to 6 feet long

______b. Consists of a tube about ½ to 1 inch in diameter and about 20 to 23 feet long

______c. Extends from the pyloric opening to the ileocecal valve

______d. The mucous lining has no villi.

______e. Greatest amount of digestion and absorption occurs here.

______f. Extends from the ileum to the anus

______g. The mucous lining has villi.

Written Test

21. Match the portions of the small intestine on the right with the correct characteristics.

_____a. Middle portion of small intestine

_____b. Lower end of small intestine

_____c. Upper part of the small intestine

_____d. Attaches to the pyloric end of the stomach and extends to the jejunum

_____e. Is about 12 to 15 feet long

_____f. Ends at the ileocecal valve where it joins the colon at a right angle

_____g. Is about 10 inches long

_____h. Is about 8 feet long

_____i. Most common site for ulcers

1. Jejunum
2. Ileum
3. Duodenum

22. Match divisions of the large intestine on the right with the correct descriptions.

_____a. Is about 5 feet long and extends from the ileocecal junction to the rectum

_____b. The terminal part of the large intestine

_____c. First 2 to 3 inches of large intestine

_____d. Ileum, colon, and appendix all open into it

_____e. Is a continuous tube, but is subdivided into four sections—Ascending, transverse, descending, and sigmoid

_____f. Ends at an external opening called the anus, which contains an internal and an external sphincter muscle

_____g. Last 7 to 8 inches of the GI tract

1. Anal canal
2. Colon
3. Rectum
4. Cecum

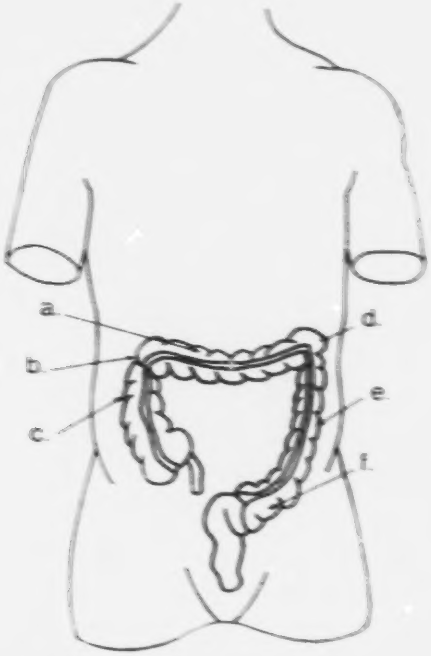
Written Test

23. Identify the sections and flexures of the colon.

a. ____________ d. ____________

b. ____________ e. ____________

c. ____________ f. ____________



24. Select true statements concerning the blood supply to the large intestine by placing an "X" next to the true statements.

______a. Arteries are derived mainly from the superior and inferior mesenteric arteries.

______b. Branches of superior mesenteric artery supply the cecum, appendix, ascending, and transverse colon.

______c. Branches of the inferior mesenteric artery supply the descending colon and the rectum.

______d. The rectum also receives a supply from branches of the gastric arteries.

Written Test

25. Complete the following statements concerning the liver by circling the correct answers.

    a. Is the (largest, second largest) gland of the body

    b. Is completely covered by a tough, fibrous sheath called (Vater's, Glisson's) capsule

    c. Is (first, last) organ to receive blood (through portal vein) from the intestines where the blood has absorbed the final products of digestion and decomposition

    d. Lies immediately (above, under) the diaphragm in the right hypochondriac and epigastric regions

    e. The upper convex surface fits (above, under) the diaphragm.

    f. The lower concave portion fits over the kidney, ascending colon, and (cardiac, pyloric) end of the stomach.

26. Select the functions of the liver by placing an "X" next to the correct functions.

______a. Stores iron and vitamins B_{12}, A, D, E, and K

______b. Stores iron and vitamins B_1, B_2, B_3, and C

______c. Stores bile

______d. Produces bile

______e. Manufactures antibodies

______f. Changes proteins into substances for elimination (urea)

______g. Manufactures fibrinogen and prothrombin

______h. Manufactures vitamin D

______i. Manufactures heparin which helps prevent blood from clotting in intact vessels

______j. Destroys cholesterol

______k. Removes bacteria and foreign substances from the bloodstream by a process called phagocytosis

Written Test

27. Complete the following statements concerning the ducts of the liver by filling in the blanks with the correct answers.

    a. Small bile ducts within the liver join to form two larger ducts which emerge from the under concave surface of the liver as the right and left hepatic ducts and immediately join to form the common __________________ duct.

    b. The common hepatic duct from the liver joins with the __________________ duct from the gallbladder to form the __________________ duct.

    c. This opens into the duodenum at an enlargement called the ________________.

    d. This is located 3 to 4 inches below the __________________ opening of the stomach.

28. Select the ligaments of the liver by placing an "X" next to the correct ligaments.

    ______a. Round ligament

    ______b. Falciform ligament

    ______c. Hepatic ligament

    ______d. Coronary ligament

    ______e. Biliary ligament

    ______f. Two lateral or triangular ligaments

    ______g. Broad ligament

29. Select the lobes of the liver by placing an "X" next to the correct lobes.

    ______a. Small

    ______b. Right

    ______c. Left

    ______d. Upper

    ______e. Quadrate

    ______f. Caudate

Written Test

30. Complete the following statements concerning the blood supply to the liver by circling the correct answers.

    a. The blood vessels of the liver are the hepatic artery, hepatic veins, and the (biliary, portal) vein.

    b. The hepatic artery brings arterial blood to the liver directly from the (gastric artery, aorta).

    c. The (biliary, portal) vein carries venous blood from the (esophagus, stomach), spleen, pancreas, and intestines back to the liver to be detoxified.

    d. The hepatic veins carry blood from the hepatic artery and portal vein to the (inferior, superior) vena cava.

31. Complete the following statements concerning the gallbladder by filling in the blanks with the correct answers.

    a. Is a ________________-shaped sac found in the gallbladder fossa on the undersurface of the liver in the upper right quadrant, and is held in place by connective tissue.

    b. Is about ________________ long, 1 inch wide, and holds about 36 cc. of bile

    c. Is composed of ________________ coats

    d. The gallbladder and bile ducts have involuntary muscle in their walls and are therefore capable of contracting and forcing bile into the ________________.

32. Complete the following statements concerning the pancreas by circling the correct answers.

    a. Lies transversely (in front of, behind) the stomach and duodenum in the right and left upper quadrants

    b. Is divided into (three, four) portions

    c. The head of the pancreas fills the C-curve of the duodenum to which it is firmly attached; the body extends horizontally across the posterior abdominal wall and the tail touches the (spleen, liver).

    d. Usually 6 to 9 inches in length, 1 to 1½ inches in width, ½ to 1 inch thick, and weighs about 2 or 3 (ounces, pounds)

Written Test

e. Special cells of the pancreas manufacture (gastric, pancreatic) juice which is carried by the pancreatic duct to the duodenum; this fluid is important in the digestion of all foods.

f. The pancreatic duct and the (hepatic, common bile) duct unite and form the Ampulla of Vater.

g. The pancreas also has special cells called Islands of Langerhans which lie in clusters between the pancreatic cells and are scattered throughout its structure, and produce (insulin, growth hormones).

*Permission to duplicate this test is granted.

Digestive System
Unit 8

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

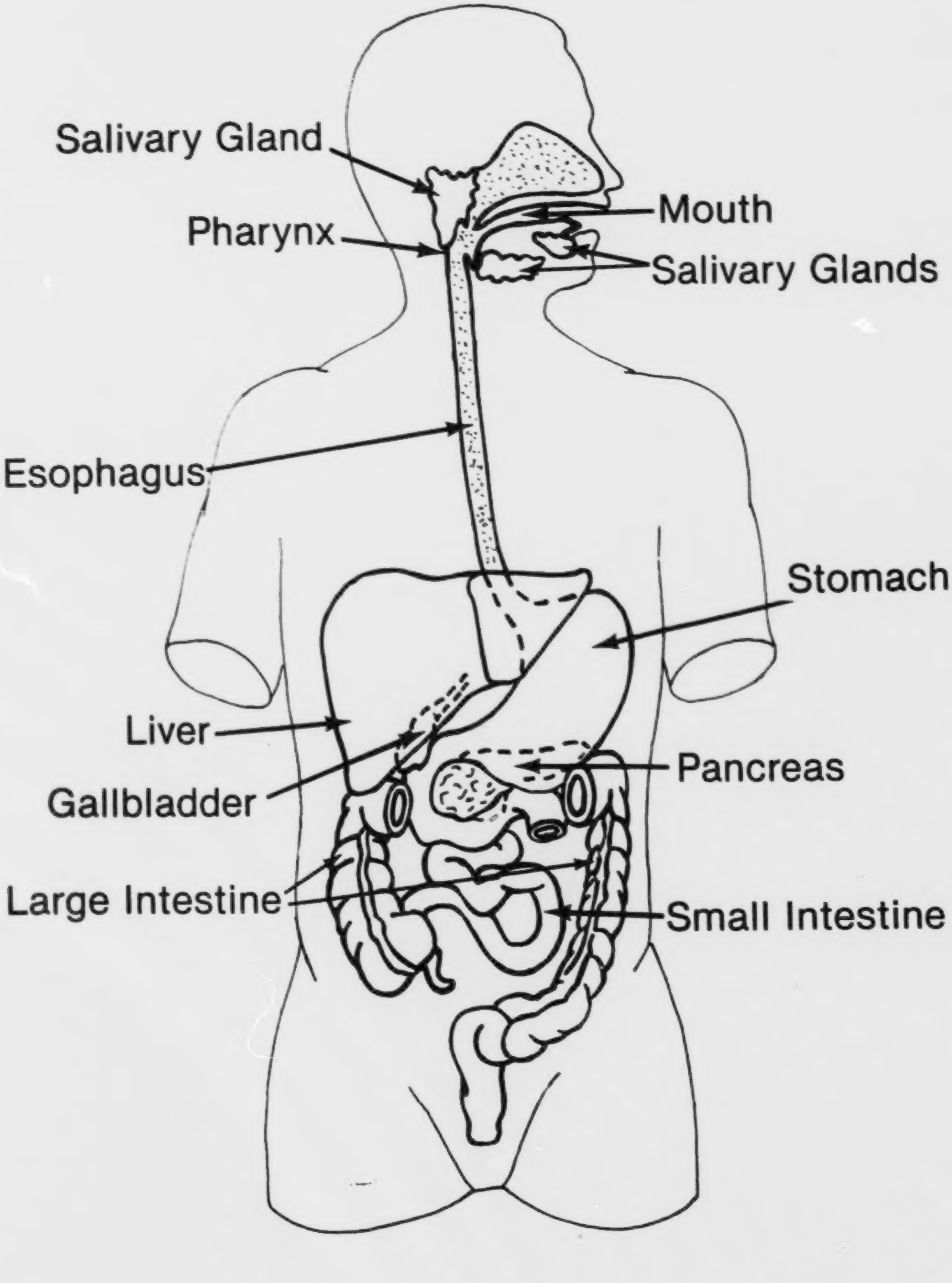
____

Teacher Signature ______________________________ Date __________

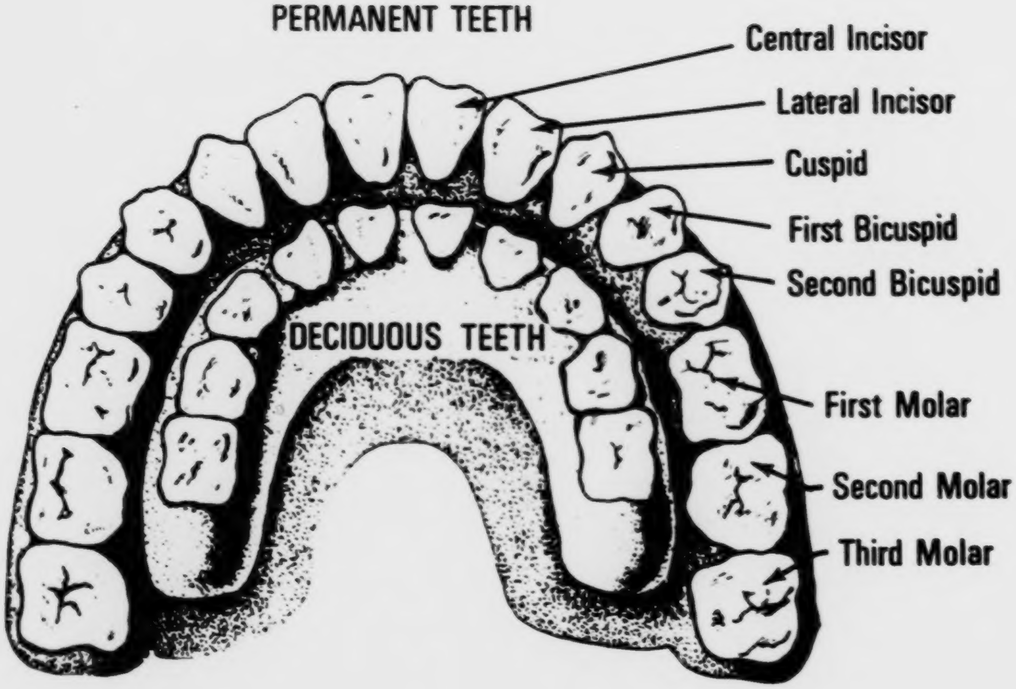
Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.

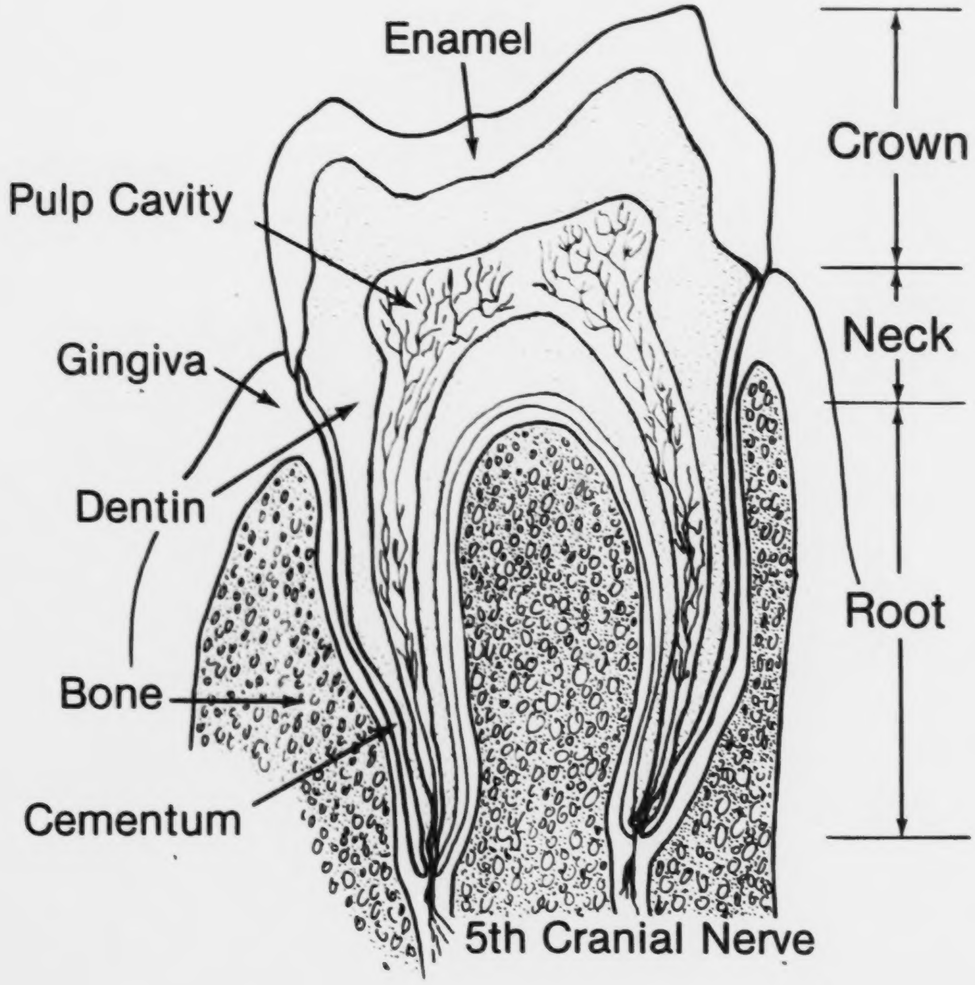
The Digestive Organs


Salivary Gland
Pharynx
Mouth
Salivary Glands
Esophagus
Stomach
Liver
Gallbladder
Pancreas
Large Intestine
Small Intestine

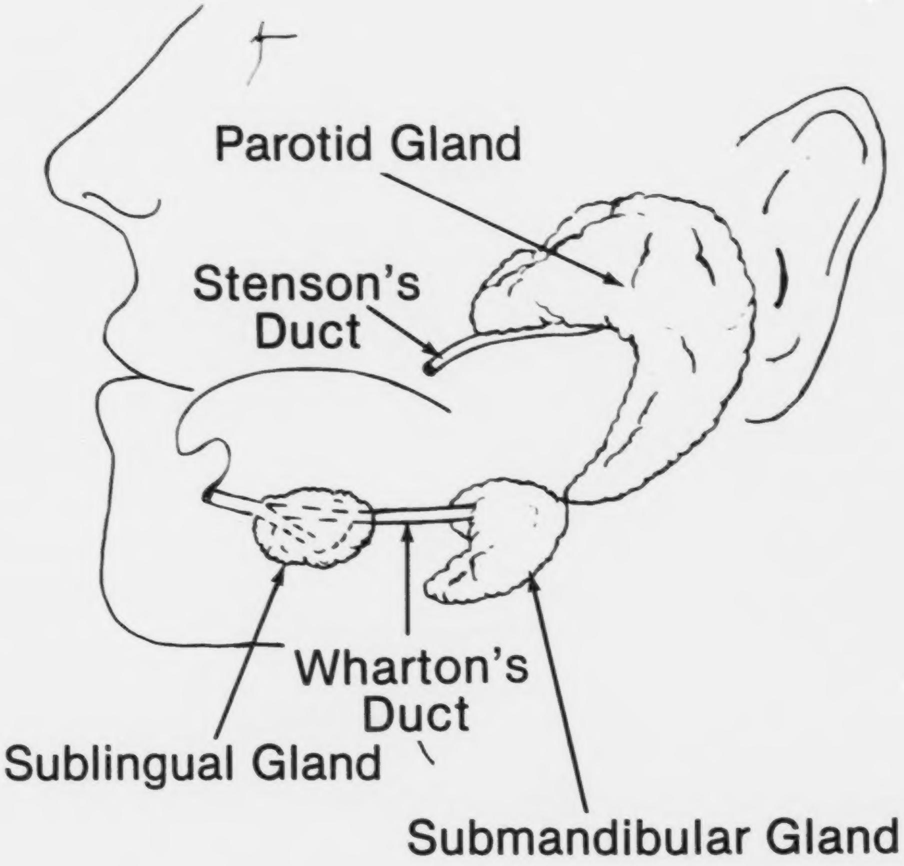
Deciduous and Permanent Teeth


PERMANENT TEETH
Central Incisor
Lateral Incisor
Cuspid
First Bicuspid
Second Bicuspid
DECIDUOUS TEETH
First Molar
Second Molar
Third Molar

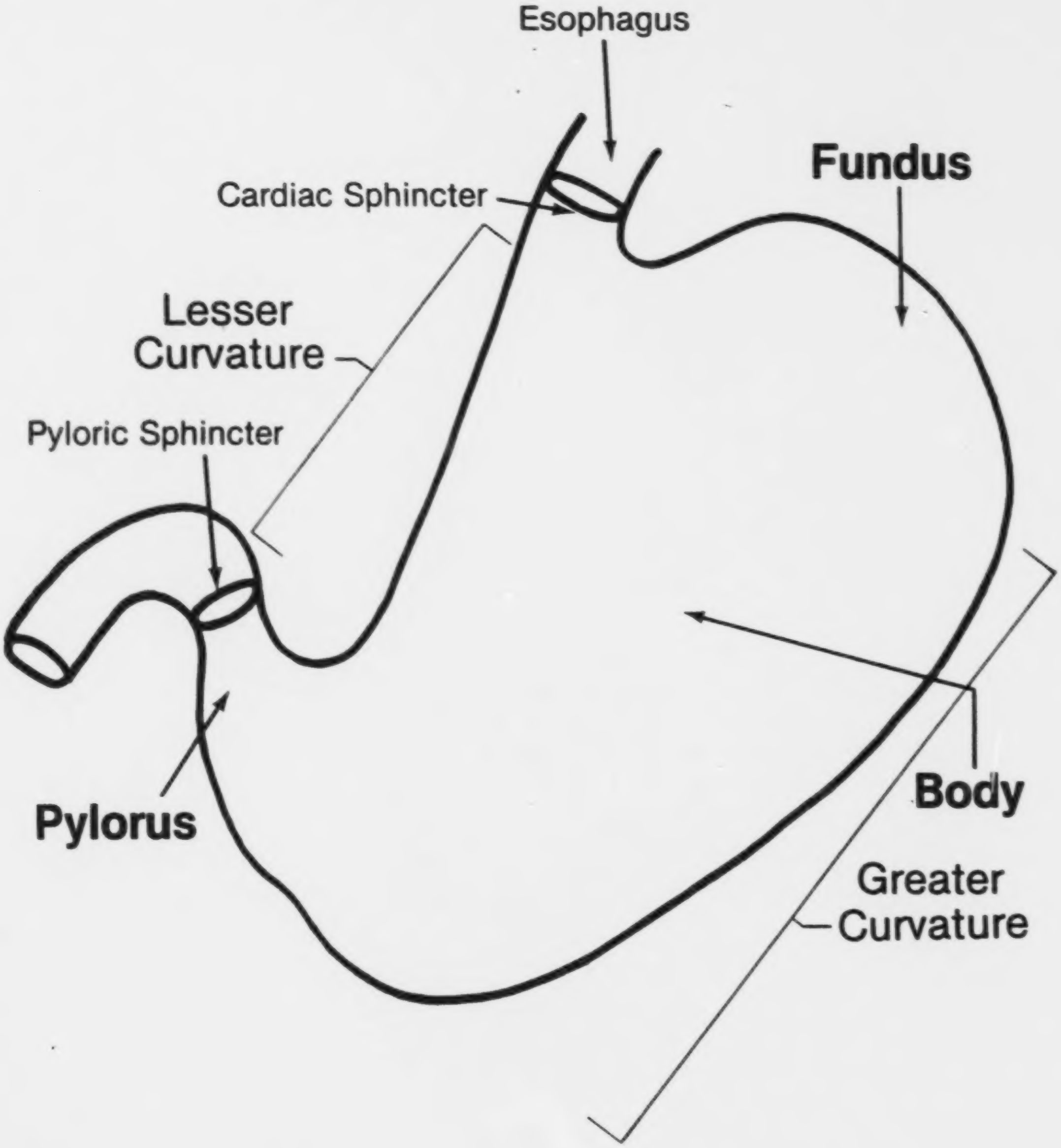
Structure of a Molar


Enamel
Pulp Cavity
Gingiva
Dentin
Bone
Cementum
5th Cranial Nerve
Crown
Neck
Root

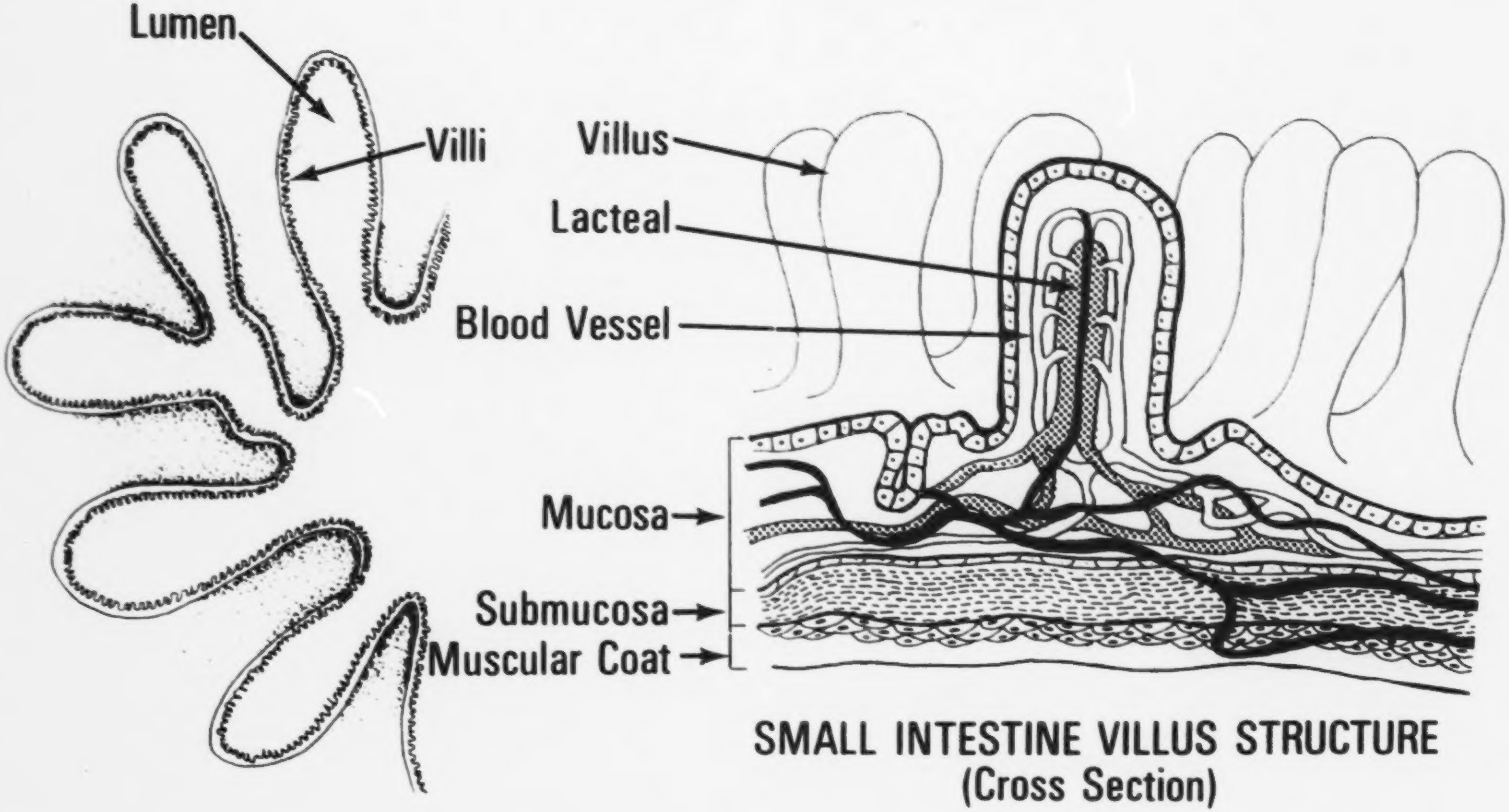
The Salivary Glands


Parotid Gland
Stenson's Duct
Wharton's Duct
Sublingual Gland
Submandibular Gland

Parts of the Stomach


Esophagus
Fundus
Cardiac Sphincter
Lesser Curvature
Pyloric Sphincter
Body
Pylorus
Greater Curvature

Structure of the Villi

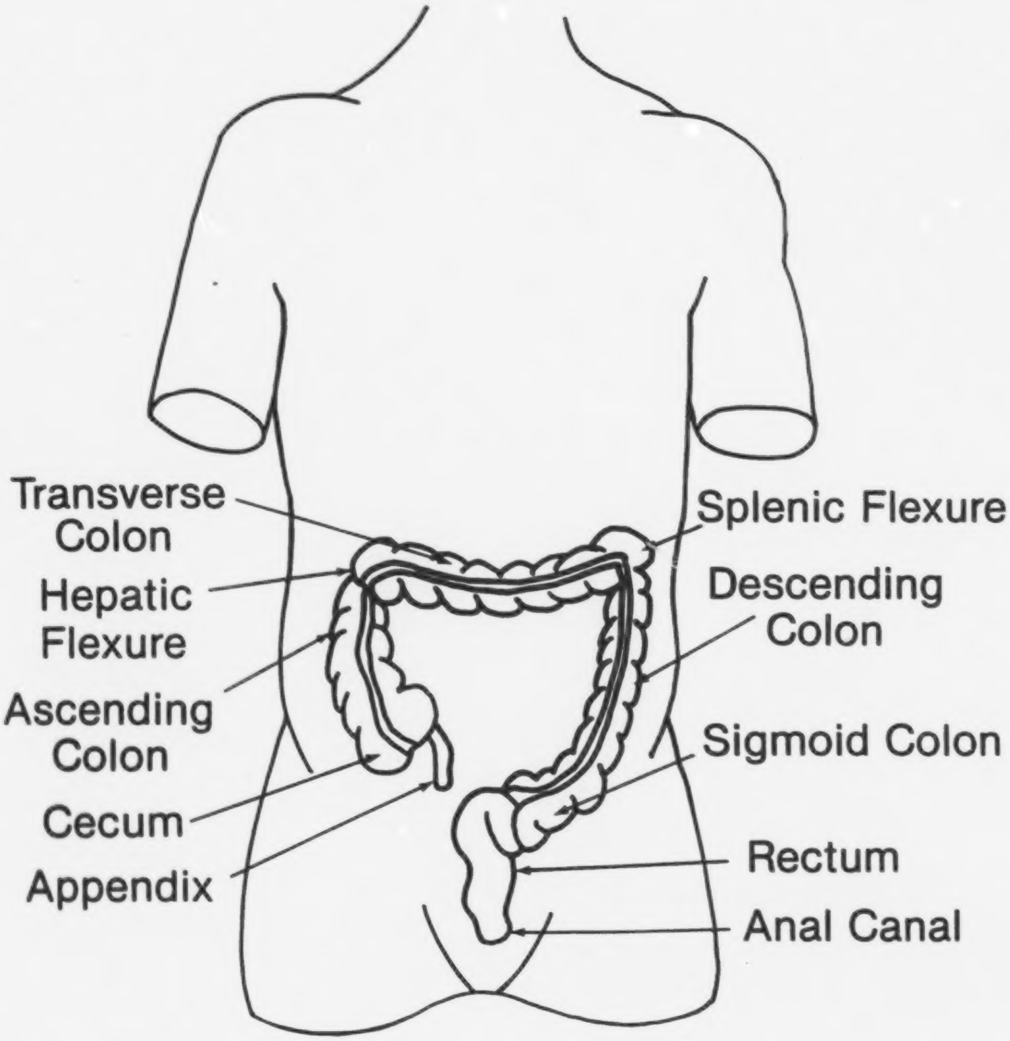

Lumen
Villi
Villus
Lacteal
Blood Vessel
Mucosa
Submucosa
Muscular Coat

SMALL INTESTINE VILLUS STRUCTURE
(Cross Section)

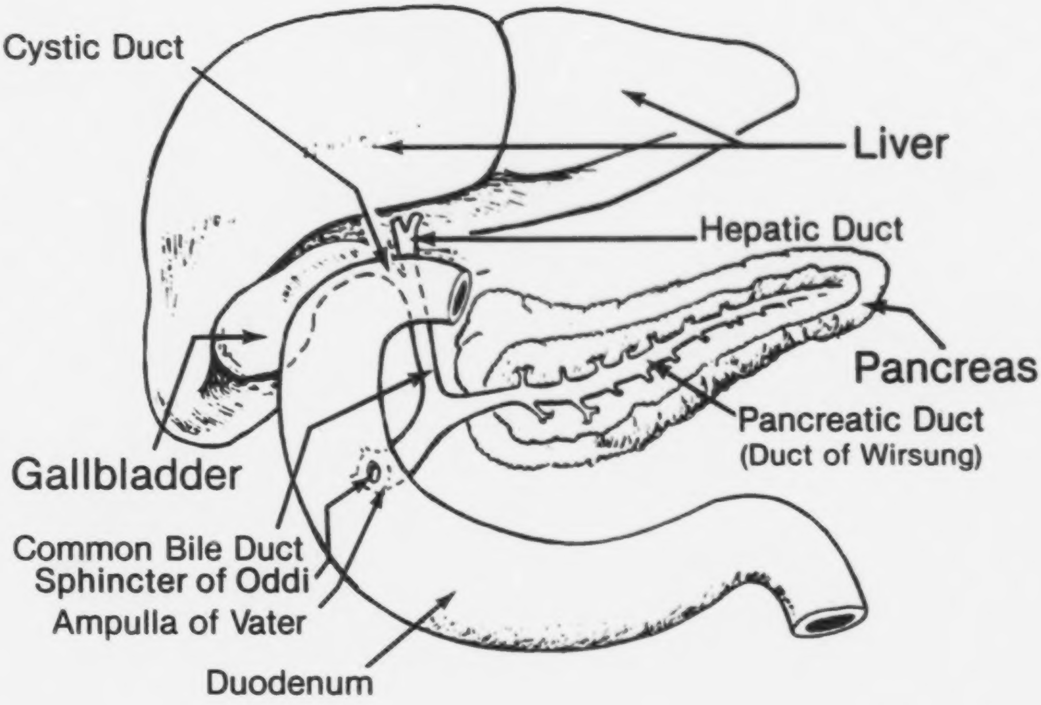
405

406

Parts of the Large Intestine


Transverse Colon
Hepatic Flexure
Ascending Colon
Cecum
Appendix
Splenic Flexure
Descending Colon
Sigmoid Colon
Rectum
Anal Canal

The Liver, Gallbladder, and Pancreas


Cystic Duct
Liver
Hepatic Duct
Pancreas
Pancreatic Duct
(Duct of Wirsung)
Gallbladder
Common Bile Duct
Sphincter of Oddi
Ampulla of Vater
Duodenum

Digestive System
Unit 8

Information Sheet

1. **Terms and definitions**

   a. **Alimentary** — Pertaining to nutrition

   b. **Atresia** — Imperforation or closure of a normal tubular opening of the body

   Examples: Esophageal atresia, biliary atresia

   c. **Bile** — A yellow or greenish viscid alkaline fluid secreted by the liver which aids in the digestion and absorption of fats

   d. **Chyme** — The thick, nearly liquid mixture of partly digested food and digestive secretions found in the stomach and small intestine during digestion

   e. **Digestion** — The process by which food is broken down, mechanically and chemically, in the gastrointestinal tract and is converted into absorbable forms

   f. **Diverticulum** — A sac or pouch in the walls of an organ

   g. **Enzyme** — Complex protein which is capable of inducing a chemical change in another substance

   Examples: Pepsin, amylase

   h. **Fauces** — Constricted opening leading from the mouth bound by the soft palate, base of tongue, and the palatine arches

   Note: The faucial reflex brings about gagging or vomiting when the fauces are irritated.

   i. **Flatus** — Gas in digestive tract

   j. **Gastritis** — Inflammation of the stomach

   k. **Gastroenterology** — The branch of medical science dealing with the physiology and pathology of the stomach, intestines, and related structures such as liver, gallbladder, and pancreas

   l. **Gingivitis** — Inflammation of the gums (gingiva)

   m. **Hydrochloric acid** — A solution of hydrogen chloride (HCl) present in gastric juice which is necessary for digestion

Information Sheet

n. **Mastication** — Chewing

o. **Meckel's diverticulum** — A diverticulum of the ileum about three feet above the ileocecal junction

p. **Mesentery** — A peritoneal fold encircling the greater part of the small intestine and connecting the intestine to the posterior abdominal wall

q. **Peristalsis** — A progressive, wave-like movement that occurs involuntarily in hollow tubes of the body, especially the alimentary canal, to force the contents of the tube onward

r. **Peritoneum** — The serous membrane reflected over the viscera and lining the abdominal cavity

s. **Peritonitis** — Inflammation of the peritoneum

t. **Pyloric stenosis** — Abnormal narrowing or stricture of the pylorus

u. **Pylorospasm** — Spasmodic contraction of the pylorus

v. **Rugae** — Folds of mucous membrane seen on internal surface of stomach

w. **Stomatitis** — Inflammation of the mouth

x. **Ulcer** — An open sore or lesion of the skin or a mucous membrane

2. **Description of the alimentary canal**

a. Is approximately 30 to 32 feet in length

b. Extends in one long tube from the mouth to the anus

c. Lies in the ventral cavity of the body

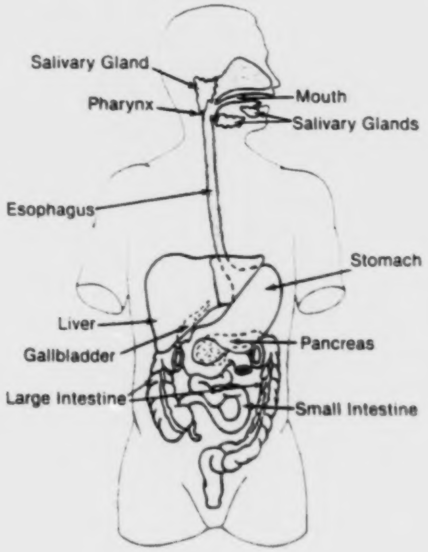
d. Is also referred to as the gastrointestinal tract (GI tract)

e. Consists of primary and accessory organs

Information Sheet

3. Organs which form the alimentary canal

Figure 1


Salivary Gland
Pharynx
Mouth
Salivary Glands
Esophagus
Stomach
Liver
Gallbladder
Pancreas
Large Intestine
Small Intestine

a. **Primary organs**

  (1) Mouth

  (2) Pharynx

  (3) Esophagus

  (4) Stomach

  (5) Small intestine

  (6) Large intestine

b. **Accessory organs**

  (1) Teeth

  (2) Tongue

  (3) Salivary glands

  (4) Pancreas

  (5) Liver

  (6) Gallbladder

Information Sheet

4. **Functions of the digestive system**

   a. Breaks down food in preparation of absorption by the body

   b. Absorbs the broken down food

   c. Discharges wastes resulting from digestion using large intestine

5. **Anatomy of the abdominopelvic cavity**

   a. Is the division of the ventral cavity lying inferior to the diaphragm

   b. Is lined and its organs are covered with a serous membrane known as peritoneum

   c. The posterior walls are lined with the parietal peritoneum.

      (1) Projects in a double-fold into the abdominal cavity

      (2) Most of the small intestine is attached to its outer edge which is known as mesentery.

      (3) The mesentery is a fan-shaped, double fold of parietal peritoneum by which the small intestine is anchored to the posterior abdominal wall.

      (4) The mesentery's outer edge is 20 feet wide, and the posterior edge is 6 to 8 inches wide.

   d. The abdominal organs and upper surface of some of the pelvic organs are covered by the visceral peritoneum.

   e. The space between the parietal and visceral peritoneum is the peritoneal cavity.

   f. The greater omentum is a fatty, apron-shaped, double-fold of peritoneum.

      (1) Is attached at its upper border to the duodenum and lower edge of the stomach and transverse colon.

      (2) Hangs loosely over abdominal viscera

      (3) Gives warmth, protection, and aids in walling off localized inflammation in the abdomen when peritonitis is present.

   g. The lesser omentum

      (1) Is a separate fold of peritoneum extending between the stomach and the liver

      (2) Connects the lesser curvature of the stomach with the left lobe of the liver

Information Sheet

6. **Functions of the peritoneum**

   a. Prevents friction between contiguous organs by secreting serum which acts as a lubricant

   b. Holds the abdominal and pelvic organs in position (to a limited extent)

   c. Unites abdominal organs and separates pelvic organs

7. **Coats (layers of tissue) composing the walls of the alimentary canal**

   a. **Mucosa or mucous coat** — Innermost layer that lines the organs and contains glands

   b. **Submucosa or submucous coat** — Contains blood vessels, lymphatics, and nerves

   c. **Muscular coat** — Consists of non-striated muscular tissue

   d. **Serous coat (visceral peritoneum)** — Outermost coat which covers all parts except the posterior wall of some organs

8. **Organs of the alimentary canal and their functions**

   a. **Primary organs**

      (1) Mouth — To begin the breakdown of food physically and chemically, and to move food on to the pharynx

      (2) Pharynx — To act as passageway for air from nasal cavity to larynx and for food from mouth to esophagus, and to act as a resonating cavity for voice production

      (3) Esophagus — To act as a passageway for food from pharynx to stomach

      (4) Stomach — To connect esophagus to small intestine, to secrete gastric juices which aid in digestion of food, and to serve as a temporary receptacle for food while it undergoes certain mechanical and chemical processes which change food to chyme

      (5) Small intestine — For the greatest amount of digestion and absorption of food, to receive bile and pancreatic juices, and to produce prosecretin which stimulates the associated digestive organs to produce their secretions

      Note: Prosecretin is changed to secretin by the action of the hydrochloric acid in the intestinal mucosa.

      (6) Large intestine — To reabsorb water and to discharge the wastes resulting from digestion

Information Sheet

b. **Accessory organs**

(1) Teeth — To chew, crush, and grind food

(2) Tongue — To make speech possible, to taste food, to force food between teeth, and to move food through mouth

(3) Salivary glands — To secrete saliva which lubricates food making it easier to chew and swallow which contains digestive juices to act upon carbohydrates and soften food

(4) Pancreas — Has various special cells which produce pancreatic juice and insulin

(5) Liver — Produces bile, stores glycogen, regulates the changing of glucose to glycogen and glycogen to glucose, stores iron and certain vitamins (fat-soluble), and changes protein into substances (urea) for elimination

Note: The liver also has other non-digestive functions which will be discussed in a later objective.

(6) Gallbladder — Stores and concentrates bile and contracts to eject bile into small intestine when needed

9. **Mouth (buccal cavity)**

a. Nearly oval-shaped cavity enclosed by cheeks and lips

b. Roof of mouth is formed by the hard and soft palate.

(1) Hard palate

(a) Consists of a hard portion in front formed by processes of the maxillae and palatine bones which are covered by periosteum and mucous membrane

(b) Aids in speech production

(2) Soft palate

(a) Is a movable fold of mucous membrane suspended from the posterior border

(b) Hanging from its lower border is a conical process called the uvula

(c) Prevents passage of food to nose

Information Sheet

c. Most of the floor of the mouth is formed by the tongue.

Note: The tongue is anchored to the floor of the mouth at the midline undersurface of the tongue by a fold of mucous membrane known as the frenulum.

d. The mouth contains teeth which physically break down food.

(1) The teeth are set in sockets called alveolar processes.

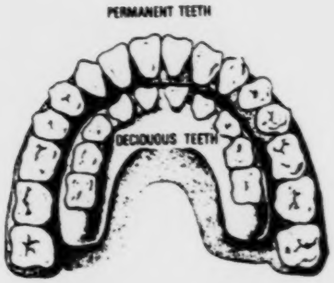
Note: Each socket is called an alveoli.

(a) Sockets are lined with peridental membrane which attaches teeth to the socket and is a source of nourishment.
(b) Sockets are covered by the gums.

(2) The gums are dense connective tissues covered by mucous membrane, and are called gingiva.

(3) Two sets of teeth develop during life.

Figure 2



(a) 20 deciduous teeth (baby teeth) appear between 6 months to one year of age; most are shed from age six to 13 years.
(b) 32 permanent teeth replace deciduous teeth and appear between ages six and 17 years.

Note: The last to appear are wisdom teeth or third molars, usually around the 17th year.

e. The mouth contains three pairs of salivary glands.

Information Sheet

10. **Types of teeth (classified according to shape and use)** (Figure 3)

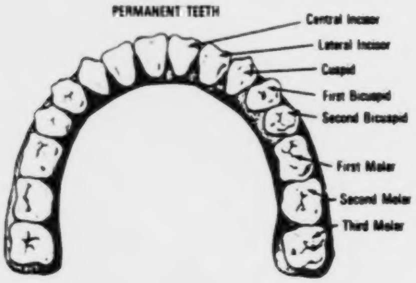
    a. Incisors (8) — Adapted for biting food

    b. Cuspids (4) — Adapted for biting and tearing food

    c. Bicuspids (premolors) (8) — Adapted for grinding food

    d. Tricuspids (molars) (12) — Adapted for crushing food

Figure 3


PERMANENT TEETH
Central Incisor
Lateral Incisor
Cuspid
First Bicuspid
Second Bicuspid
First Molar
Second Molar
Third Molar

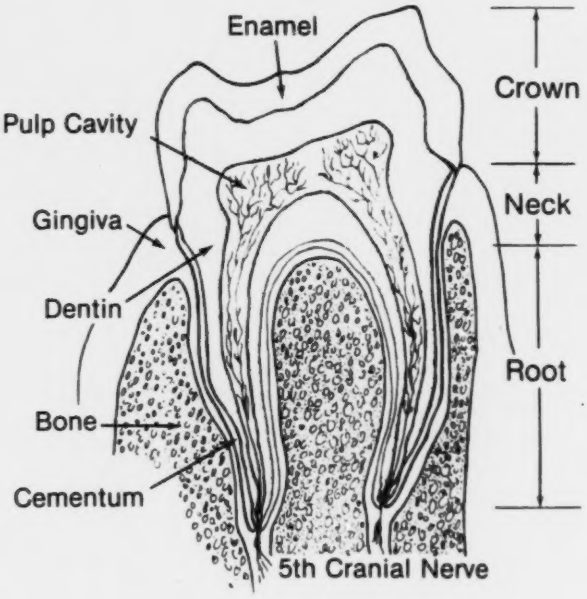
11. **Three portions of a tooth**

    a. Root

    b. Neck

    c. Crown

Figure 4—Structure of a molar


Enamel
Crown
Pulp Cavity
Neck
Gingiva
Dentin
Root
Bone
Cementum
5th Cranial Nerve

Information Sheet

12. **Salivary glands** (Figure 5)

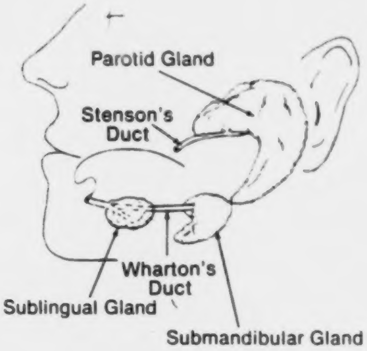
    a. **Parotid** — Largest glands located under and in front of each ear; secrete clear, watery serous fluid and an enzyme called amylase

    Note: This is the gland that becomes infected in the condition known as mumps.

    b. **Submandibular (submaxillary)** — Glands located in the posterior part of the floor of the mouth; secrete primarily serous fluid with some mucus

    c. **Sublingual** — Glands located in the anterior part of the floor of the mouth; secrete primarily thick mucus

    Figure 5



13. **Pharynx (throat cavity)**

    a. Is a musculo-membrane tube that extends from the back of the throat to the beginning of the esophagus

    b. Is divided into three parts:

       (1) Nasopharynx — Located in the superior portion of the throat behind the nasal cavity above the palate

       (2) Oropharynx — Located in the midportion of the throat behind the mouth between the palate and the hyoid bone

       (3) Laryngopharynx — Located in the inferior portion of the throat just above the larynx and below the hyoid bone

Information Sheet

14. Esophagus (Gullet)

a. Is a muscular, collapsible tube about 10 inches long, which begins at the lower end of the pharynx and ends in the upper or cardiac portion of the stomach

b. Has no peritoneal coat as it lies in the thoracic cavity

c. Lies posterior to the heart and trachea

d. Goes through the esophageal hiatus in the diaphragm in its descent from the thoracic to the abdominal cavity

e. Walls of the esophagus are composed of four layers:

  (1) Serous or fibrous coat

  (2) Muscular coat

  (3) Submucous coat

  (4) Mucous coat

f. Food is propelled into the stomach by peristaltic contractions.

15. Stomach

a. Is an elongated pouch lying obliquely in the left upper quadrant in the epigastric, umbilical, and left hypochondriac regions

b. Size varies with sex and other factors.

Note: The female stomach is smaller and more slender that the male stomach.

c. Can hold up to two quarts of food until it is ready to be received into the small intestine

d. Dilates according to amount of food ingested

e. When not distended, the mucous coat lies in folds known as rugae.

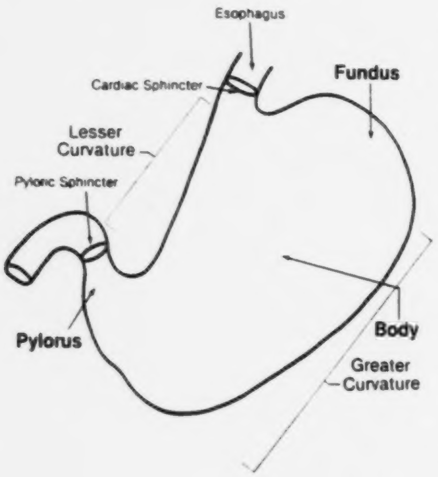
Information Sheet

16. **Openings of the stomach** (Figure 6)

    a. **Cardiac** — Located at the upper end of the stomach where the esophagus joins the stomach

    b. **Pyloric** — Located at the lower end of the stomach where the stomach joins the small intestine (duodenum)

Figure 6


Esophagus
Fundus
Cardiac Sphincter
Lesser Curvature
Pyloric Sphincter
Pylorus
Body
Greater Curvature

17. **Curvatures of the stomach** (Figure 6)

    a. **Greater curvature** — Lower convex edge from the cardiac opening to the pyloric opening

    b. **Lesser curvature** — Upper concave edge of the stomach from the cardiac opening to the pyloric opening

18. **Parts of the stomach** (Figure 6)

    a. **Fundus** — The portion located above the cardiac opening

    Note: This is known as the rounded tip portion of the stomach.

    b. **Body** — Central portion of the stomach

    c. **Pylorus** —Constricted part before the pyloric opening

Information Sheet

19. Blood and nerve supply to the stomach

a. **Blood supply**

(1) Comes from the gastric artery which is one of the three divisions of the celiac artery

(2) Gastric veins unite with the superior mesenteric vein which empties into the portal vein.

b. **Nerve supply**

(1) Receives terminal branches of the right vagus nerve to the dorsal side of the stomach

(2) Receives terminal branches of the left vagus nerve to the ventral side of the stomach

(3) Receives thoracolumbar (sympathetic) autonomic nerve fibers from the celiac plexus

Note: Stimulation of the vagus fibers increases secretion and peristalsis, whereas stimulation of the thoracolumbar autonomic fibers inhibits secretion and peristalsis.

20. Small and large intestines

a. **Small intestine**

(1) Consists of a tube about $\frac{1}{2}$ to 1 inch in diameter and about 20 to 23 feet long

(2) Extends from the pyloric opening to the ileocecal valve (opening to the colon)

(3) Is located in the central and lower part of the abdominal cavity

(4) Greatest amount of digestion and absorption occurs here.

(5) Has folds of rugae which have two purposes:

(a) To prevent food from passing through the intestines too quickly
(b) To present a greater surface area for the absorption of digested food

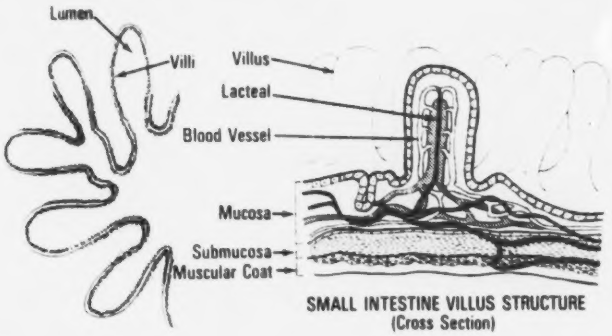
Information Sheet

(6) Throughout the small intestine, there are microscopic, velvety-appearing, fingerlike projections known as villi. (Figure 7)

(a) Each villus consists of a central lymph channel called a lacteal for the absorption of some fats.

(b) After food has been digested, it passes into the capillaries and lacteals of the villi and is absorbed.

Figure 7—Structure of the villi


Lumen
Villi
Villus
Lacteal
Blood Vessel
Mucosa
Submucosa
Muscular Coat
SMALL INTESTINE VILLUS STRUCTURE
(Cross Section)

b. **Large intestine**

(1) Consists of a tube about 2½ inches in diameter which decreases in size toward the end of the tube, and is approximately 5 to 6 feet long

(2) Extends from the ileum to the anus

(3) The mucous lining has no villi.

(4) The mucous lining contains intestinal glands and solitary lymph nodes.

21. Portions of the small intestine

Note: Although the small intestine is a continuous tube, it has been divided into three portions for locational purposes.

a. **Duodenum**

(1) Upper part of the small intestine

(2) Attaches to the pyloric end of the stomach and extends to the jejunum

(3) Is about 10 inches long

(4) Is the shortest and broadest part of the small intestine

(5) Is the most common site for ulcers

Information Sheet

b. **Jejunum**

(1) Middle portion of small intestine

(2) Extends from the duodenum to the ileum

(3) Located in the upper, central part of the abdomen

(4) Is about 8 feet long

c. **Ileum**

(1) Lower end of small intestine

(2) Extends from the jejunum to the junction with the colon at the cecum

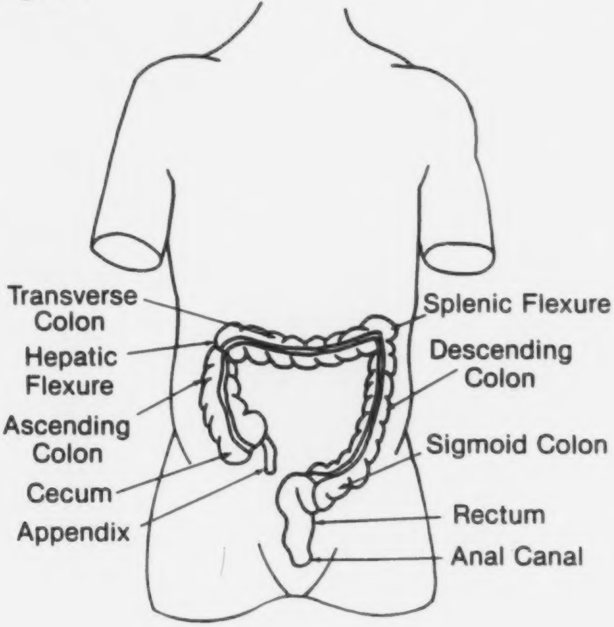
(3) Ends at the ileocecal valve where it joins the colon at a right angle

Note: The opening of the ileocecal valve is guarded by a sphincter muscle which prevents the return of material that has been discharged into the large bowel.

(4) Is about 12 to 15 feet long

22. Divisions of the large intestine

Figure 8


Transverse Colon
Hepatic Flexure
Ascending Colon
Cecum
Appendix
Splenic Flexure
Descending Colon
Sigmoid Colon
Rectum
Anal Canal

Information Sheet

a. **Cecum with vermiform appendix**

(1) First 2 to 3 inches of large intestine

(2) Located in RLQ of abdomen between the small intestine and the colon

(3) Vermiform appendix is a worm-shaped diverticulum of the cecum which is 3 to 6 inches long.

Note: The function of the appendix is not known.

(4) Ileum, colon, and appendix all open into the cecum.

b. **Colon**

(1) Is about 5 feet long and extends from the ileocecal junction to the rectum

(2) Is a continuous tube, but is subdivided into four sections—Ascending, transverse, descending, and sigmoid colon

c. **Rectum**

(1) Last 7 to 8 inches of the GI tract

(2) Located between the sigmoid colon and the anal canal

(3) Originates at the level of the 3rd sacral vertebra and descends along the curve of the sacrum and coccyx and finally bends sharply backward into the anal canal

d. **Anal canal**

(1) The terminal part of the large intestine

(2) Is about 1 to 1½ inches in length

(3) Ends at an external opening called the anus, which contains an internal and an external sphincter muscle

Note: These muscles are kept closed except for defecation.

(4) The anal canal's mucous lining is arranged in numerous vertical folds know as rectal columns or Houston valves, each of which contains an artery and a vein.

Note: Hemorrhoids are enlargements of veins in the anal canal.

Information Sheet

23. **Sections and flexures of the colon** (Figure 8)

   a. **Ascending colon**

      (1) Lies in vertical position on right side of abdomen and extends to lower border of the liver

      (2) Here it bends abruptly to the left, and the location where it bends is called the right colic or hepatic flexure.

   b. **Transverse colon (Mesial colon)**

      (1) Passes across the upper abdomen, below the liver and the stomach and above the small intestine, to the spleen in the upper left abdomen

      (2) Here it curves downward to the right beneath the lower end of the spleen and the location where it bends downward is called the left colic or splenic flexure.

   c. **Descending colon**

      (1) Lies in a vertical position on the left side of the abdomen and extends from a point below the stomach to the level of the iliac crest

      (2) Here it begins to curve like the letter "S."

   d. **Sigmoid colon** — S-shaped curved portion of the distal colon, which extends from the descending colon and curves downward below the iliac crest to join the rectum

24. **Blood supply to the large intestine**

   a. Arteries are derived mainly from the superior and inferior mesenteric arteries.

   b. Branches of superior mesenteric artery supply the cecum, appendix, and ascending and transverse colon.

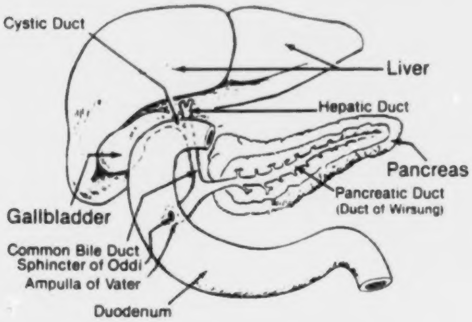
   c. Branches of the inferior mesenteric artery supply the descending colon and the rectum.

   d. The rectum also receives a supply from branches of the hypogastric arteries.

Information Sheet

25. **Liver** (Figure 9)

Figure 9—Liver, gallbladder, and pancreas


Cystic Duct
Liver
Hepatic Duct
Pancreas
Pancreatic Duct (Duct of Wirsung)
Gallbladder
Common Bile Duct
Sphincter of Oddi
Ampulla of Vater
Duodenum

a. Is the largest gland of the body

b. Is completely covered by a tough, fibrous sheath called Glisson's capsule

c. Is the first organ to receive blood (through portal vein) from the intestines where the blood has absorbed the final products of digestion and decomposition

Note: This is not intended to nourish the liver. Rather, the liver detoxifies the blood before it goes to the heart.

d. Lies immediately under the diaphragm in the right hypochondriac and epigastric regions

e. The upper convex surface fits under the diaphragm.

f. The lower concave portion fits over the kidney, ascending colon, and pyloric end of the stomach.

26. **Functions of the liver**

a. Produces bile which is stored in the gallbladder and is released when needed for the digestive process

b. Forms an internal secretion which regulates the changing of glucose to glycogen to be stored in the liver. As the body needs more glucose than food furnishes, the glycogen is changed back into glucose to be used by the body.

c. Stores iron and vitamins B_{12}, A, D, E, and K

d. Changes proteins into substances for elimination (urea)

Information Sheet

e. Manufactures fibrinogen and prothrombin (blood clotting factors)

f. Manufactures heparin (anticoagulant) which helps prevent blood from clotting in intact vessels

g. Manufactures antibodies

h. Removes bacteria and foreign substances from the bloodstream by a process called phagocytosis

i. Regulates blood volume

j. Produces body heat

k. Detoxifies harmful substances such as drugs and poisons which have entered the bloodstream

l. Manufactures cholesterol

27. **Ducts of the liver** (Figure 9)

a. Small bile ducts within the liver join to form two larger ducts which emerge from the under concave surface of the liver as the right and left hepatic ducts and immediately join to form the common hepatic duct.

b. The common hepatic duct from the liver joins with the cystic duct from the gallbladder to form the common bile duct (CBD).

c. The common bile duct opens into the duodenum at an enlargement called the Ampulla (or papilla) of Vater.

d. The Ampulla of Vater is located 3 to 4 inches below the pyloric opening of the stomach.

e. The neck of the Ampulla of Vater is guarded by a sphincter muscle called the Sphincter of Oddi.

Note: If an obstruction of the hepatic duct or common bile duct occurs, a condition known as jaundice will result. This is a yellow discoloration of the skin and mucosa. Bile cannot flow through its normal exit in the small intestine. Therefore, it is absorbed by the bloodstream which gives the skin the yellow discoloration.

Information Sheet

28. Ligaments of the liver

Note: The liver is connected to the undersurface of the diaphragm and the anterior walls of the abdomen by five ligaments.

a. Falciform ligament (1) — Formed by folds of peritoneum; this divides liver into right and left lobes

b. Coronary ligament (1) — Formed by folds of peritoneum

c. Two lateral or triangular ligaments (2) — Formed by folds of peritoneum

d. Round ligament (1) — A fibrous cord resulting from atrophy of the umbilical vein of intrauterine life

29. Lobes of the liver

a. Right (largest lobe)

b. Left (smaller and wedge-shaped)

c. Quadrate (square)

d. Caudate (tail-like)

30. Blood supply to the liver

a. The blood vessels of the liver are the hepatic artery, hepatic veins, and the portal vein.

b. The hepatic artery brings arterial blood to the liver directly from the aorta.

Note: This is for the nourishment of the liver.

c. The portal vein carries venous blood from the stomach, spleen, pancreas, and intestines back to the liver to be detoxified before the venous blood reenters the inferior vena cava (IVC).

Note: The blood brought to the liver by the portal vein is venous blood and is not intended for purposes of nourishment of the liver itself.

d. The hepatic veins carry blood from the hepatic artery and portal vein to the inferior vena cava.

Information Sheet

31. **Gallbladder** (Figure 9)

   a. Is a pear-shaped sac found in the gallbladder fossa on the undersurface of the liver in the upper right quadrant, and is held in place by connective tissue

   b. Is about 3 to 4 inches long, 1 inch wide, and holds about 36 cc. of bile

   c. Is composed of three coats:

      (1) Mucous membrane — Inner lining

      (2) Muscular and fibrous tissue — Middle layer

      (3) Serous membrane — Outer covering derived from peritoneum

      Note: Only occasionally does the peritoneum cover more than the undersurface of the organ. The uppersurface connects directly to the liver.

   d. The gallbladder and bile ducts have involuntary muscle in their walls and are therefore capable of contracting and forcing bile into the duodenum.

32. **Pancreas** (Figure 9)

   a. Lies transversely behind the stomach and duodenum in the right and left upper quadrants

   b. Is divided into three portions:

      (1) Head

      (2) Body

      (3) Tail

   c. The head of the pancreas fills the C-curve of the duodenum to which it is firmly attached; the body extends horizontally across the posterior abdominal wall and the tail touches the spleen.

   d. Varies in size according to sex and individual.

   Note: It is usually larger in men than in women.

   e. Usually is 6 to 9 inches in length, 1 to 1½ inches in width, ½ to 1 inch thick, and weighs about 2 or 3 ounces

Information Sheet

f. Special cells of the pancreas manufacture pancreatic juice which is carried by the pancreatic duct to the duodenum. This fluid is important in the digestion of all foods.

g. The pancreatic duct (Duct of Wirsung) and the common bile duct unite and form the Ampulla of Vater.

h. The pancreas also has special cells called Islands (Islets) of Langerhans which

    (1) Lie in clusters between the pancreatic cells and are scattered throughout its structure

    (2) Produce the hormones insulin and glucagon

    (3) Have no ducts so their secretions of insulin are directly absorbed by the blood capillaries

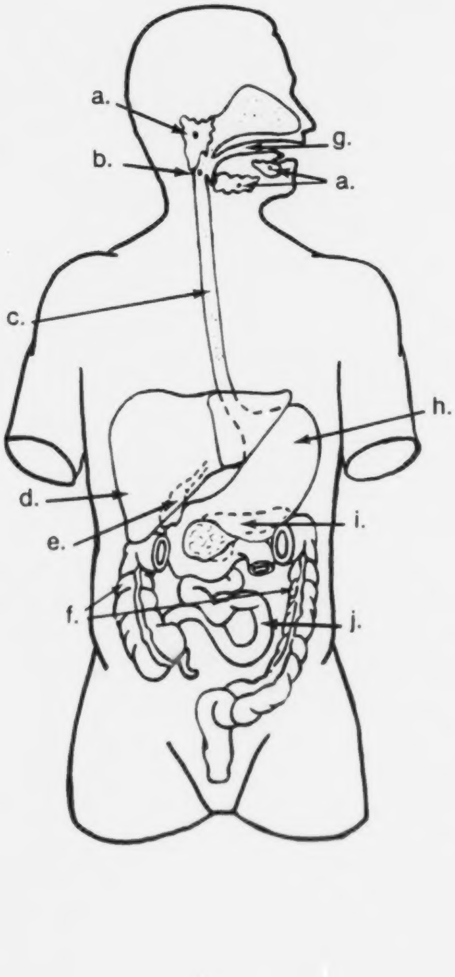
Digestive System
Unit 8

Student Supplement 1—Identify the Organs Which Form the Alimentary Canal

Name ______________________________

Directions: Identify the organs in the following illustration, and place your answers in the blanks provided.

a.	____________________	f.	____________________
b.	____________________	g.	____________________
c.	____________________	h.	____________________
d.	____________________	i.	____________________
e.	____________________	j.	____________________



Digestive System
Unit 8

Student Supplement 2—Identify the Parts of the Stomach

Name ____

Directions: Identify the parts of the stomach in the following illustration, and place your answers in the blanks provided.

a. __________________________

b. __________________________

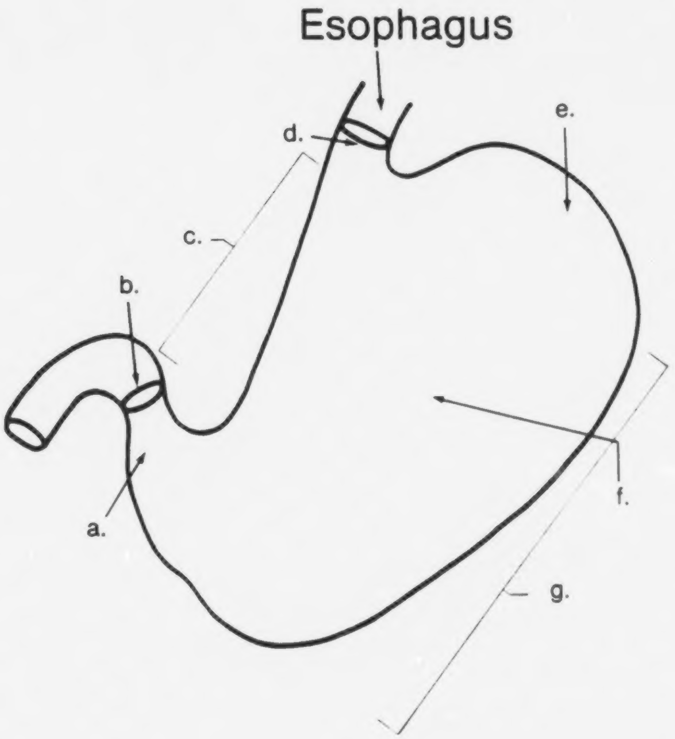
c. __________________________

d. __________________________

e. __________________________

f. __________________________

g. __________________________



Digestive System
Unit 8

Student Supplement 3—Identify the Parts of the Large Intestine

Name ______________________________

Directions: Identify the divisions of the large intestine, the sections of the colon, and the flexures in the following illustration. Place your answers in the blanks provided.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

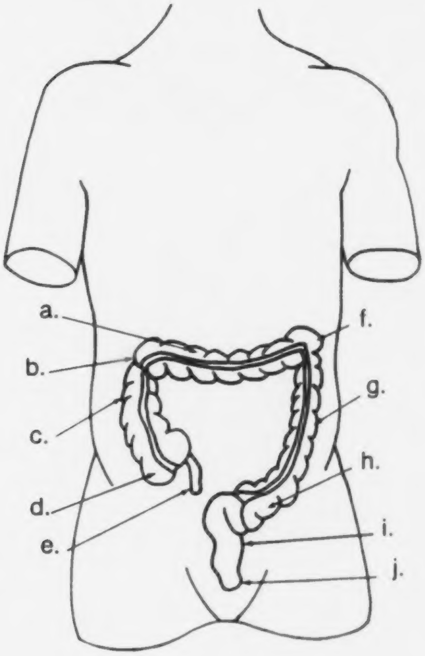
f. ____________________

g. ____________________

h. ____________________

i. ____________________

j. ____________________



Digestive System
Unit 8

Student Supplement 4—Complete Statements Concerning the Digestive System

Name ______________________________________

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

______ 1. Pancreatic juice is emptied from the pancreas by way of a duct into the

a. Duodenum
b. Ileum
c. Jejunum
d. Stomach

______ 2. When a patient has the mumps, which glands become swollen?

a. Sublingual
b. Thyroid
c. Submaxillary
d. Parotid

______ 3. The serous membrane which covers the surface of most of the abdominal organs and lines the abdominal cavity is the

a. Perineum
b. Mesentery
c. Omentum
d. Peritoneum

______ 4. The large intestine is referred to as the

a. Vermiform
b. Ileum
c. Duodenum
d. Colon

______ 5. The muscular digestive tube extending through the body is called the

a. Gullet
b. Intestinal tube
c. Alimentary canal
d. Mesentery canal

Student Supplement 4

_____ 6. The normal liver manufactures fibrinogen. When the liver is diseased, there is a decrease of this substance in the blood, and the patient must be watched carefully for

a. Cyanosis (the skin appearing blue in color)
b. Elevation of body temperature
c. Drop of blood pressure
d. Signs of bleeding internally or externally

_____ 7. The parotid glands secrete

a. Hormones
b. Serous fluid
c. Mucus
d. Bile

_____ 8. The absorption of most nutritive elements obtained from digested food takes place in the

a. Stomach
b. Small intestine
c. Large intestine
d. Colon

_____ 9. The gallbladder

a. Stores and concentrates bile
b. Stores sugar as glycogen
c. Produces bile
d. Contains glands which secrete digestive enzymes

_____10. An accessory organ of digestion is the

a. Large intestine
b. Stomach
c. Esophagus
d. Salivary glands

_____11. There are glands in the walls of the stomach that secrete substances which aid in digestion. These substances include

a. Saliva
b. Hormones
c. Vitamins
d. Hydrochloric acid

Student Supplement 4

______12. The appendix is attached to the

a. Duodenum
b. Cecum
c. Ileum
d. Jejunum

______13. Secretions that chemically aid digestion are

a. Enzymes
b. Vitamins
c. Adrenalin
d. Hormones

______14. The small intestine includes the

a. Rectum
b. Duodenum
c. Cecum
d. Sigmoid

______15. A function of the stomach is

a. To reabsorb fluids
b. To store food until it can be partially digested
c. To secrete bile
d. To begin digestion of fats

______16. The ileocecal valve acts to

a. Prevent backflow of matter into the small intestine
b. Allow food to pass into the duodenum
c. Prevent passage of material into the large intestine
d. Allow passage of fecal matter into the rectum

______17. The sphincter muscle located at the lower end of the stomach is called the

a. Cardiac
b. Pyloric
c. Duodenal
d. Ileocecal

Student Supplement 4

______18. A substance secreted by the Islands of Langerhans which is important in the utilization of glucose is

a. Adrenalin
b. Ptyalin
c. Pancreatin
d. Insulin

______19. The combination of gastric juice and food is known as

a. Chyle
b. Chyme
c. Omentum
d. Flatus

______20. The mucous lining of the small intestine is greatly increased in area by tiny velvet fingerlike projections called

a. Cilia
b. Gilli
c. Villi
d. Rugae

______21. The largest gland in the body is the

a. Pancreas
b. Gallbladder
c. Parotid
d. Liver

______22. Carbohydrate digestion is initiated in the

a. Mouth
b. Stomach
c. Gallbladder
d. Pancreas

______23. Temporary or baby teeth are known as

a. Permanent incisors
b. Eye teeth
c. Deciduous teeth
d. Cuspids

Student Supplement 4

______24. Some fats are absorbed by way of the lymphatic capillaries of the villi, which are called

a. Chyle
b. Cisterna chyle
c. Lacteals
d. Caries

______25. Pancreatic juice is important because it aids in the digestion of

a. All food substances
b. Fatty acids
c. Amino acids
d. Carbohydrates

______26. The openings of the salivary glands are located in the

a. Mouth
b. Stomach
c. Pancreas
d. Small intestine

______27. The rhythmic wave of contractions that moves food along the digestive tract is called

a. Peristalsis
b. Osmosis
c. Absorption
d. Metabolism

______28. Water is absorbed from the digestive tract primarily in the

a. Esophagus
b. Stomach
c. Small intestine
d. Large intestine

______29. Mechanical digestion of food requires tongue action because the tongue

a. Supplies a lubricating secretion
b. Provides taste stimulations
c. Moves food around to the various grinding surfaces and mixes food with saliva
d. Breaks food into smaller pieces against the hard palate so that the saliva can cover each particle

Student Supplement 4

______30. The crown of the tooth can be described as that part which

a. Is below the gum line
b. Is above the gum line
c. Protects the pulp
d. Provides nourishment to the tooth

______31. Gastric juice is secreted in the

a. Mouth
b. Small intestine
c. Liver
d. Stomach

______32. The shape of front teeth best fits them for the job of

a. Grinding
b. Cutting and dividing
c. Chewing
d. Cutting food into tiny particles

______33. The flat edges of the back teeth enable us to rub the teeth back and forth in a

a. Grinding action
b. Scissors action
c. Rotary motion
d. Protective motion

______34. The proximal part and the distal part of the large intestine are respectively called the

a. Ascending colon and descending colon
b. Cecum and anal canal
c. Sigmoid and rectum
d. Cecum and sigmoid

______35. Three accessory organs that aid in digestion of food but do not form the digestive tract itself are the

a. Pharynx, esophagus, and stomach
b. Pancreas, liver, and gallbladder
c. Cecum, colon, and sigmoid
d. Appendix, cecum, and rectum

Student Supplement 4

______36. The structure of the mouth whose functions include tasting, helping in swallowing, chewing, and aiding in speech is/are the

a. Epiglottis
b. Pharynx
c. Teeth
d. Tongue

______37. The structure of the mouth which functions to initiate the physical breakdown of food is/are the

a. Cheeks
b. Salivary glands
c. Teeth
d. Pharynx

______38. The three parts of the small intestine are the

a. Appendix, cecum, and colon
b. Sigmoid, rectum, and anal canal
c. Duodenum, jejunum, and ileum
d. Ascending colon, transverse colon, and descending colon

______39. The name of the duct which carries bile from the liver to the cystic duct is the

a. Common bile duct
b. Hepatic duct
c. Pancreatic duct
d. Wharton duct

______40. The hepatic duct and the cystic duct connect to form the

a. Pancreatic duct
b. Common bile duct
c. Pancreas
d. Iliac duct

______41. The following main organs form the alimentary canal: the mouth, esophagus, intestines, stomach, and the

a. Gallbladder
b. Pancreas
c. Liver
d. Pharynx

Student Supplement 4

______42. The membrane which attaches the liver to the lesser curvature is called the

a. Greater omentum
b. Mesentery
c. Parietal peritoneum
d. Lesser omentum

______43. When bile ducts are obstructed and bile is absorbed by the bloodstream, the condition is known as

a. Hepatitis
b. Peristalsis
c. Jaundice
d. Cyanosis

______44. What is the name of the curve where the ascending colon bends to the left?

a. Hepatic flexure
b. Ampulla of Vater
c. Sigmoid flexure
d. Splenic flexure

______45. The pancreatic and common bile ducts unite and enter the duodenum together in a dilated tube called the

a. Ligament of Treitz
b. Hepatic flexure
c. Island of Reil
d. Ampulla of Vater

______46. The sockets in which the teeth are set are called

a. Mandibular processes
b. Cement
c. Dentin
d. Alveolar processes

______47. Another name for gums is

a. Cilia
b. Frenulum
c. Uvula
d. Gingiva

Student Supplement 4

______48. Permanent sets of teeth contain how many teeth?

a. 32
b. 15
c. 20
d. 18

______49. The longest portion of the small intestine is the

a. Cecum
b. Duodenum
c. Ileum
d. Jejunum

______50. The largest lobe of the liver is the

a. Left
b. Right
c. Quadrate
d. Caudate

Circulatory System
Unit 9

Objective Sheet

Unit Objective

After completing this unit, the student should be able to complete statements concerning blood and its constituents, the parts of the heart, and types of blood vessels. The student should also be able to trace the circulation of blood through the heart. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the circulatory system with their correct definitions.
2. List functions of the circulatory system.
3. Match organs of the circulatory system with the correct functions.
4. Match the constituents of blood with the correct functions.
5. Complete statements concerning the characteristics of red blood cells.
6. Complete statements concerning the characteristics of white blood cells.
7. Complete statements concerning the characteristics of platelets.
8. Complete statements concerning the physical characteristics of blood.
9. State the composition of blood plasma and their percentages.
10. Select true statements concerning the Rh factor.
11. Complete statements concerning the four blood groups.
12. Complete statements concerning the blood clotting mechanism.
13. Complete statements concerning the structure of the heart.
14. Complete statements concerning the covering of the heart.
15. Match the layers of the heart with the correct descriptions.

Objective Sheet

16. Distinguish between the chambers of the heart.
17. Match the valves of the heart with the correct descriptions.
18. Select the orifices of the heart.
19. Trace the circulation of blood through the heart.
20. Select true statements concerning the blood supply of the heart.
21. Complete statements concerning the nerve supply of the heart.
22. Complete statements concerning the characteristics of arteries.
23. Select true statements concerning the characteristics of veins.
24. Complete statements concerning the characteristics of capillaries.
25. Complete an illustration of the circulation of blood through vessels.
26. Distinguish between the types of circulation.
27. Complete statements concerning the major components of pulmonary circulation.
28. Distinguish between the parts of the aorta.
29. Match the major arteries of systemic circulation with the correct areas they drain.
30. Match the major veins of systemic circulation with the correct areas they drain.
31. Complete statements concerning portal circulation.

Circulatory System
Unit 9

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Red Blood Cells (Objective 5
   TM 2—White Blood Cells and Platelets (Objectives 6 and 7)
   TM 3—Ameboid Action of Leukocytes (Objective 6)
   TM 4—Composition of Blood (Objective 8)
   TM 5—Structure of the Heart (Objectives 13, 16-19)
   TM 6—Blood Supply to the Heart (Objective 20)
   TM 7—Coronary Arteries (Objective 20)
   TM 8—Blood Vessels (Objective 22)
   TM 9—Principal Arteries (Objective 29)
   TM 10—Principal Veins (Objective 30)
   TM 11—Portal Circulation (Objective 31)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

Suggested Activities

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

    Note: Due to the length of this unit, you may wish to teach and evaluate in smaller sections.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Obtain various pamphlets and brochures on the functioning of the heart from the local or national heart association.

2. Show available films concerning the circulatory system.

3. Demonstrate the anatomy of the heart using other illustrations or models.

4. Have students' blood typed or have students assist in the typing (optional).

5. Provide examples of hospital blood reports, and discuss the procedure for reading the relevant parts.

Suggested Activities

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis, MO: C. V. Mosby Company, 1987.
2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.
3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.
4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Supplemental Resources

1. Brochures and other supplementary information are available from:

   American Heart Association
   7320 Greenville Avenue
   Dallas, TX 75231
   214-373-6300

2. Videotapes

   a. *Two Hearts that Beat as One*

   b. *Breath of Life*

   c. *Life Under Pressure*

   d. *Hot and Cold*

   a-d are part of *The Living Body* Series available from:

   Films for the Humanities and Sciences
   P.O. Box 2053
   Princeton, NJ 08543-2053
   800-257-5126 or 609-452-1128

Suggested Activities

e. *The Red River*, part of *The Body Human* Series available from:

  Medcom/Trainex
  Box 3225
  Garden Grove, CA 92641
  800-877-1443

f. *I Am Joe's Heart*, part of the *I Am Joe's* Series available from several sources. Two companies offering this series include the following:

  (1) Medcom/Trainex
  Box 3225
  Garden Grove, CA 92641
  800-877-1443

  (2) Pyramid Film and Video
  P.O. Box 1048
  Santa Monica, CA 90406-1048
  800-421-2304

g. *Circulatory System*, second edition, part of the *Human Body Series*

h. *Heart and Circulation*, part of *Your Active Body Series*

  g-h are available from:

  Coronet Films
  108 Wilmot Road
  Deerfield, IL 60015-5196
  800-777-8100

3. Anatomy charts and models on the heart and circulatory system are available from many health and science education companies. Two of these are as follows:

  a. Health Edco
  P.O. Box 21207
  Waco, TX 76702-1207
  800-299-3366, x295 or 817-776-6461, x295

  b. Nebraska Scientific
  3823 Leavenworth Street
  Omaha, NB 68105
  800-228-7117

Circulatory System
Unit 9

Answers to Student Supplements

Student Supplement 1

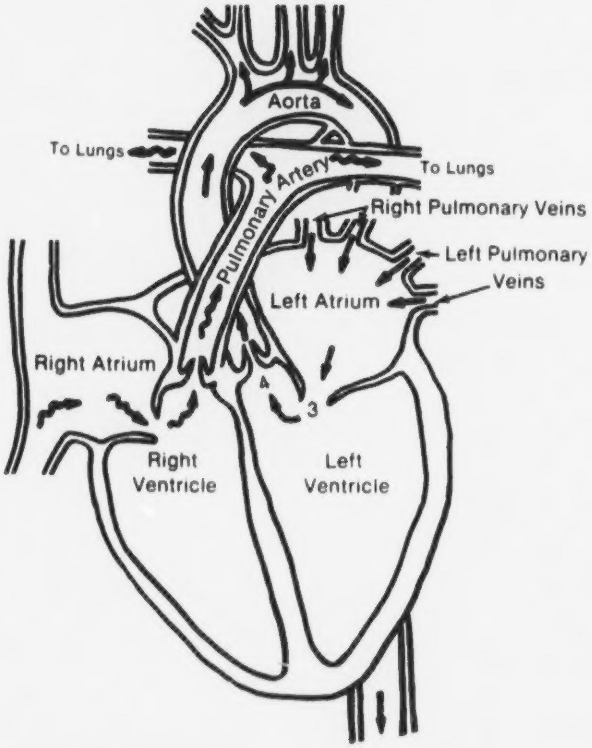
1. b
2. d
3. d
4. a
5. a
6. a
7. b
8. d
9. d
10. c
11. c
12. a
13. b
14. a
15. c
16. b
17. c
18. a
19. b
20. c
21. d
22. c
23. d
24. c
25. c

Student Supplement 2

a. Superior vena cava
b. Right atrium
c. Inferior vena cava
d. Tricuspid valve
e. Right ventricle
f. Endocardium
g. Myocardium
h. Pericardium
i. Septum
j. Left ventricle
k. Bicuspid or mitral valve
l. Left atrium
m. Pulmonary veins
n. Pulmonary semilunar valve
o. Aortic semilunar valve
p. Pulmonary artery
q. Aorta
r. Innominate artery
s. Right subclavian artery
t. Right common carotid artery
u. Left common carotid artery
v. Left subclavian artery

Answers to Student Supplements

Student Supplement 3


Aorta
To Lungs
To Lungs
Pulmonary Artery
Right Pulmonary Veins
Left Pulmonary Veins
Left Atrium
Right Atrium
4
3
Right Ventricle
Left Ventricle

Student Supplement 4

a. Arteries
b. Arterioles
c. Capillaries
d. Venules
e. Veins

Student Supplement 5

1. b
2. d
3. b
4. a
5. d
6. c
7. a
8. d
9. c
10. c
11. d
12. b
13. d
14. d
15. b
16. a
17. b
18. c
19. d
20. d
21. b
22. d
23. b
24. b
25. d
26. b
27. b
28. d
29. a
30. a
31. d
32. c
33. c
34. d
35. a

Circulatory System
Unit 9

Answers to Written Test

1.

a.	4	f.	9	k.	11	p.	23
b.	18	g.	7	l.	5	q.	2
c.	17	h.	10	m.	20	r.	3
d.	1	i.	13	n.	12	s.	15
e.	8	j.	14	o.	22	t.	19

2. Any three of the following:
   a. Transports various substances to and from body cells such as O_2, CO_2, food, water, chemicals, hormones, and wastes
   b. Protects body against invading microorganisms
   c. Helps regulate body temperature
   d. Maintains homeostasis
   e. Transports waste products to excretory organs

3. a. 3
   b. 4
   c. 1
   d. 5

4. a. 3
   b. 4
   c. 1
   d. 2

5. a. (1) Red
      (2) Flexible
      (3) No
   b. (1) Respiratory gases
      (2) Oxygen-
   c. (1) Red
      (2) Continually
   d. (1) 120
      (2) Liver

6. a. Colorless
   b. Monocytes
   c. Phagocytes
   d. Red bone marrow
   e. 12

7. a. 3
   b. 2
   c. 4

Answers to Written Test

8. a. 1 d. 4
b. 2 e. 1
c. 3 f. 4

9. a. Water - 90
b. 10

10. c, d, e

11. a. (1) Types A, B, AB, O
(2) Type O
b. (1) Types A and AB
(2) Types A and O
c. (1) Types B and AB
(2) Types B and O
d. (1) Type AB
(2) Types A, B, AB, and O

12. a. Platelets
b. Fibrinogen
c. Thrombin
d. Fibrin
e. Blood clot

13. a. Four
b. Grams
c. Left
d. Apex, diaphragm
e. Base
f. Septum
g. Venous, arterial
h. Valves
i. Three

14. a. Two
b. Parietal
c. Visceral
d. Pericardial
e. Serous fluid
f. Excessive
g. Pericarditis

15. a. 2
b. 3
c. 1

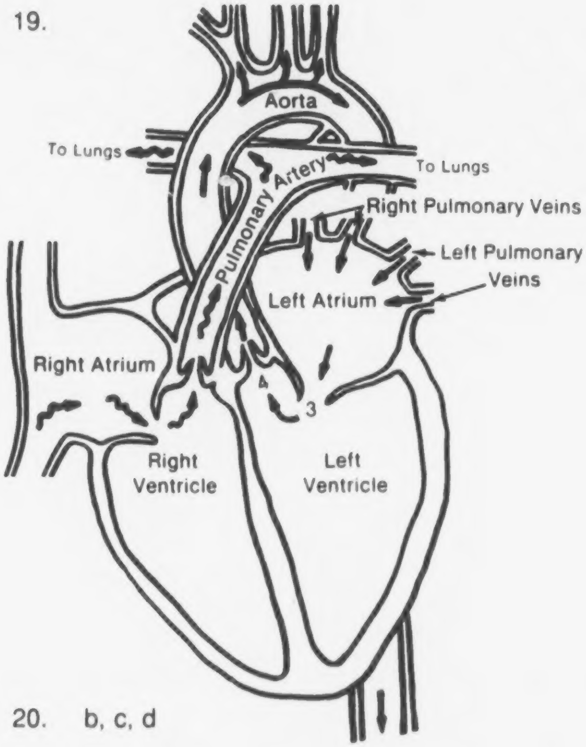
Answers to Written Test

16. a. V
b. A
c. A, L
d. V, L
e. A, R
f. A
g. V
h. V, R

17. a. 2
b. 4
c. 3
d. 1
e. 1
f. 2

18. a, d, e, g, h, j, k

19.


Aorta
To Lungs
To Lungs
Pulmonary Artery
Right Pulmonary Veins
Left Pulmonary Veins
Left Atrium
Right Atrium
4
3
Right Ventricle
Left Ventricle

20. b, c, d

21. a. Two
b. Slow or stop
c. Augment or quicken
d. Medulla oblongata

22. a. Three
b. Oxygenated
c. Arterioles
d. Aorta

Answers to Written Test

23. a, b, e, g, h, i

24. a. Minute
b. One
c. Venules
d. Osmosis
e. Million
f. Single file

25. a. Arteries
b. Arterioles
c. Capillaries
d. Venules
e. Veins

26. a, d

27. a. Pulmonary artery
b. Right ventricle (RV), left atrium (LA)
c. Carbon dioxide

28. a. DA
b. AA
c. AA
d. ARCH
e. ARCH
f. DA

29.

a.	4	f.	5	k.	2	p.	22
b.	20	g.	14	l.	12	q.	13
c.	19	h.	8	m.	11	r.	15
d.	3	i.	10	n.	21	s.	9
e.	1	j.	16	o.	17	t.	18

30.

a.	18	e.	1	i.	3	m.	10
b.	17	f.	8	j.	4	n.	9
c.	6	g.	7	k.	14	o.	12
d.	15	h.	16	l.	11	p.	5

31. a. Stomach
b. Liver
c. Hepatic

Circulatory System
Unit 9

Written Test

Name ____ Score ________________

1. Match the terms on the right with the correct definitions.

______a. The system through which the nutrient fluids of the body circulate

______b. Pertaining to the whole body rather than to one of its parts

______c. Involving the lungs

______d. The fluid that circulates through the heart and the blood vessels

______e. The science concerned with blood and the blood-forming tissues

______f. The iron-containing pigment of the red blood cells

______g. A protein formed in the blood which is related to the ability to resist infection

______h. The destruction of red blood cells with liberation of hemoglobin into the surrounding fluid

______i. Arrest of bleeding or of circulation

______j. State of equilibrium of the internal environment

______k. A sex-linked hereditary blood disease in which blood fails to clot and abnormal bleeding occurs

______l. The process of clotting

1. Blood
2. Cardiac
3. Cardiology
4. Circulatory system
5. Coagulation
6. Embolus
7. Gamma globulin
8. Hematology
9. Hemoglobin
10. Hemolysis
11. Hemophilia
12. Hemorrhage
13. Hemostasis
14. Homeostasis
15. Peripheral
16. Phlebitis
17. Pulmonary
18. Systemic
19. Thrombus

Written Test

_____m. Injection of the blood of one person into the blood vessels of another

_____n. Abnormal internal or external bleeding

_____o. Narrowing the caliber of blood vessels

_____p. Widening of blood vessels

_____q. Pertaining to the heart

_____r. The study of the heart

_____s. Pertaining to the outer part or surface of the body; part away from the center

_____t. A solid mass formed in the living heart or vessels from constituents of the blood; attached to the wall of the vessel

20. Transfusion
21. Varicose veins
22. Vasoconstriction
23. Vasodilation

2. List three functions of the circulatory system.

a. ______________________________

b. ______________________________

c. ______________________________

3. Match organs of the circulatory system on the right with the correct functions.

_____a. Pumps blood into the arteries

_____b. Carry blood to and from the heart, and thus carry oxygen and nutritive materials to the body and remove products of metabolism

_____c. Forms blood cells and hemoglobin

_____d. Carry lymph and tissue fluid, help to filter the blood, and manufacture lymphocytes

1. Red bone marrow
2. Spleen
3. Heart
4. Blood vessels
5. Lymphatic vessels and nodes

Written Test

4. Match the constituents of blood on the right with the correct functions.

______a. Liquid part of blood which serves as a source of nutrition and a means of removing waste products from the body cells

______b. Transport respiratory gases CO_2 and O_2

______c. Ingest and digest foreign particles in blood, form antibodies, and release heparin which prevents intravascular clotting

______d. Initiate blood clotting

1. White blood cells
2. Blood platelets
3. Blood plasma
4. Red blood cells

5. Complete the following statements concerning the characteristics of red blood cells by circling the correct answers.

a. Appearance and size

(1) (Clear, Red), minute, disk-shaped cells with central area thinner than the edges

(2) Very (rigid, flexible)

(3) Mature cells contain (one, no) nucleus.

b. Function

(1) Transport (liquids, respiratory gases)

(2) Hemoglobin is the (carbon dioxide-, oxygen-) carrying red pigment of the red blood cell.

c. Formation

(1) Formed in (yellow, red) bone marrow in skull, vertebrae, ribs, sternum, and proximal epiphysis of femur and humerus

(2) Formed (continually, once a day)

d. Destruction

(1) Life span is (7, 120) days.

(2) Break apart or rupture in the capillaries of the (heart, liver) and/or the spleen

Written Test

6. Complete the following statements concerning the characteristics of white blood cells by circling the correct answers.

   a. Appearance — (red, colorless) ameboid-like cells

   b. Types include neutrophils, lymphocytes (monocytes, erythrocytes), basophils, and eosinophils.

   c. Functions include (pinocytosis, phagocytosis), formation of antibodies, and release of heparin.

   d. Neutrophils, eosinophils, and basophils are formed in the (lymph nodes, red bone marrow).

   e. Life span is 1 - (12, 120) days.

7. Complete statements concerning the characteristics of platelets by selecting the best answers and placing your answers in the blanks provided.

______a. Platelets are

(1) Diamond-shaped disks
(2) Triangular-shaped disks
(3) Round or oval disks
(4) Round or oval spheres (balls)

______b. The function of platelets is to

(1) Secrete hormones
(2) Initiate clotting mechanism
(3) Secrete heparin
(4) Keep blood from clotting

______c. Platelets are formed in the

(1) Liver
(2) Heart
(3) Endocrine glands
(4) Red bone marrow

Written Test

8. Complete statements concerning physical characteristics of blood by selecting the best answers and placing your answers in the blanks provided.

_____a. Unoxygenated blood carried by veins is

(1) Purple or deep red
(2) Light red

_____b. Oxygenated blood carried by arteries is

(1) Purple or deep red
(2) Bright red

_____c. Blood tastes

(1) Slightly bitter
(2) Slightly sweet
(3) Slightly salty
(4) Slightly sour

_____d. Blood is composed of

(1) 45% plasma, 55% cells
(2) 90% plasma, 10% cells
(3) 10% plasma, 90% cells
(4) 45% cells, 55% plasma

_____e. Blood contains

(1) 78% water, 22% solids
(2) 90% water, 10% solids
(3) 98% water, 2% solids
(4) 50% water, 50% solids

_____f. The amount of blood

(1) Never varies
(2) Varies with nationality
(3) Varies with race
(4) Varies with weight

9. State the composition of blood plasma and their percentages.

a. ____________ — _____%

b. Solutes — _____%

Written Test

10. Select true statements concerning the Rh factor by placing an "X" next to the true statements.

______a. About 50% of all individuals have another red cell protein (antigen) called Rh factor and are "Rh positive."

______b. 50% of all individuals do not have this protein (antigen) and are "Rh negative."

______c. When Rh positive blood is given to an Rh negative person, the recipient can produce counteracting proteins called antibodies, which will destroy erythrocytes from Rh positive blood.

______d. An Rh negative mother may become sensitized by proteins from an Rh positive baby.

______e. During a later pregnancy, the mother's antibodies may pass into the blood of the unborn infant, and cause erythroblastosis fetalis, a destruction of the baby's erythrocytes. The baby would require a complete blood replacement with Rh negative blood.

11. Complete the following statements concerning the four blood groups by placing the blood type or types in the blanks provided.

a. Type O

(1) Donates to ____________________

(2) Receives ____________________

b. Type A

(1) Donates to ____________________

(2) Receives ____________________

c. Type B

(1) Donates to ____________________

(2) Receives ____________________

d. Type AB

(1) Donates to ____________________

(2) Receives ____________________

Written Test

12. Complete the following statements concerning the blood clotting mechanism by filling in the blanks with correct answers.

    a. When cells are injured, ________________ release thromboplastin.

    b. Liver releases prothrombin and ________________.

    c. Prothrombin and thromboplastin form ________________.

    d. Thrombin plus fibrinogen form ________________, a network of fine threads which catch red blood cells.

    e. Network becomes a ________________, called a thrombus.

13. Complete the following statements concerning the structure of the heart by circling the correct answers.

    a. A (two-, four-) chambered hollow, muscular organ, shaped roughly like a man's closed fist

    b. Weighs 250 - 350 (milligrams, grams)

    c. Lies in the mediastinum suspended by the great vessels with approximately two-thirds of its mass to the (left, right) of the midline of the body

    d. Lower border is called the (base, apex) and lies on the (liver, diaphragm) pointing to the left.

    e. Upper border is called the (base, apex) and lies below the 2nd rib.

    f. (Myocardium, Septum) goes from base to apex to divide into right and left halves.

    g. Right half contains (arterial, venous) blood, and left half contains (arterial, venous) blood

    h. Halves are divided by (septum, valves) into upper and lower resulting in four chambers.

    i. Is composed of (three, four) distinct layers

Written Test

14. Complete the following statements concerning the covering of the heart by circling the correct answers.

    a. Is called the pericardium and consists of (two, three) parts

    b. The (parietal, visceral) pericardium is the outer fibrous layer which forms the loose fitting sac in which the heart lies.

    c. The (parietal, visceral) pericardium is the inner serous layer.

    d. The (pericardial, visceral) space lies between the two layers.

    e. (Serous fluid, Mucus) fills this space.

    f. An (insufficient, excessive) amount of fluid in this space is called pericardial effusion.

    g. Inflammation of the pericardium is called (pericarditis, carditis).

15. Match the layers of the heart on the right with the correct descriptions.

    _____a. Serous membrane adherent to the outside

    _____b. Main substance of the heart, specially constructed of cardiac muscle tissue; contracts to decrease the size of the heart and force blood out of its chambers

    _____c. Lines the inner surface of the chambers of the heart, and covers the valves within the heart

    1. Endocardium
    2. Epicardium
    3. Myocardium

16. Distinguish between the chambers of the heart by placing an "A" next to the characteristics of atria and a "V" next to those of ventricles. Also circle L or R for left and right as needed.

    _____a. Lower chambers

    _____b. Upper chambers

    _____c. R or L — Receives oxygenated blood

    _____d. R or L — Pumps oxygenated blood to tissue

Written Test

______e. R or L — Receives deoxygenated blood

______f. Receiving chambers

______g. Pumping chambers

______h. R or L — Pumps deoxygenated blood to lungs

17. Match the valves of the heart on the right with the correct descriptions.

______a. Named for its three flaps or cusps

______b. Lies between the right ventricle and the pulmonary artery

______c. Lies between the left ventricle and the aorta

______d. Lies between the left atrium and left ventricle

______e. Named for its two flaps or cusps

______f. Lies between right atrium and right ventricle

1. Bicuspid or mitral
2. Tricuspid
3. Aortic semilunar
4. Pulmonary semilunar

18. Select the orifices of the heart from the following list by placing an "X" next to the correct orifices.

______a. Bicuspid or mitral valve orifice

______b. Opening for iliac vein into RA

______c. Opening for superior vena cava into LA

______d. Opening for superior vena cava into RA

______e. Opening for inferior vena cava into RA

______f. Opening for inferior vena cava into RV

______g. Tricuspid valve orifice

______h. Pulmonary orifice

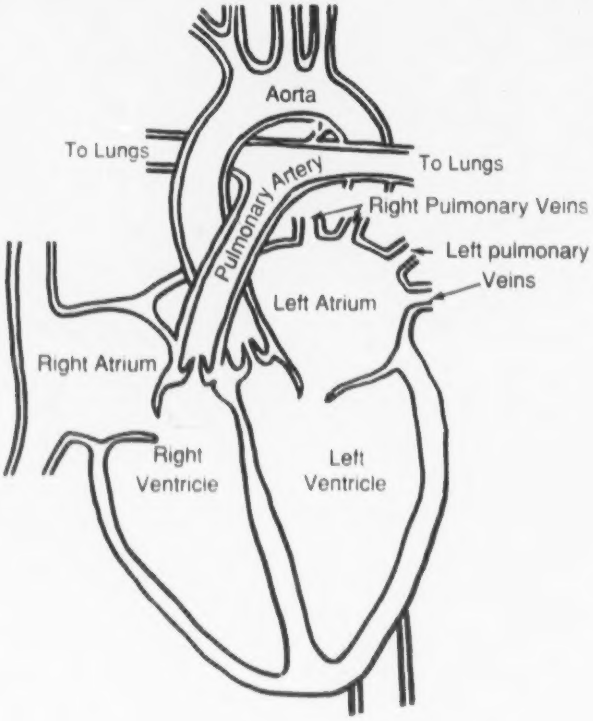
______i. Opening for iliac vein into RV

______j. Aortic orifice

______k. Four openings for pulmonary veins into LA

Written Test

19. Trace the circulation of blood through the heart. Use straight arrows to indicate oxygenated blood and wavy arrows to indicate deoxygenated blood.


Aorta
To Lungs
To Lungs
Pulmonary Artery
Right Pulmonary Veins
Left pulmonary Veins
Left Atrium
Right Atrium
Right Ventricle
Left Ventricle

20. Select true statements concerning the blood supply of the heart by placing an "X" next to the true statements.

_______a. Coronary arteries branch off the superior vena cava.

_______b. Coronary arteries encircle the heart like a crown.

_______c. Coronary arteries lie in the fatty tissue surrounding the heart.

_______d. Coronary arteries supply the myocardial substance of the heart with blood

_______e. Coronary veins return the oxygenated blood used by the cardial tissue directly to the right ventricle.

Written Test

21. Complete the following statements concerning the nerve supply of the heart by filling in the blanks with the correct answers.

    a. Has ________________ sets of motor nerve fibers

    b. One set reaches the heart through the vagus nerve and the craniosacral system, and helps to ________________ the heartbeat.

    c. The other set reaches the heart through the spinal cord and thoracolumbar system, and helps to ________________ the heartbeat.

    d. Both sets of nerves are connected with the cardiac center found in the ________________.

22. Complete the following statements concerning the characteristics of arteries by circling the correct answers.

    a. Composed of (three, four, five) layers

    b. Carry (oxygenated, deoxygenated) blood away from the heart beginning at the aorta

    c. Break up into (artules, arterioles) and capillaries

    d. The large trunk artery is the (pulmonary artery, aorta).

23. Select true statements concerning the characteristics of veins by placing an "X" next to the true statements.

    ______a. Composed of three coats

    ______b. The middle coat is muscular.

    ______c. The walls of veins are much thicker than arterial walls.

    ______d. The muscular coats is more developed and more elastic in veins than in arteries.

    ______e. Many veins are provided with valves to prevent the backflow of blood.

    ______f. Carry oxygenated blood to the body

    ______g. Small veins are known as venules.

    ______h. The two large trunk veins are the superior and inferior vena cava.

    ______i. Two sets of veins are found in most parts of the body: Superficial veins close to the skin, and deep veins which usually accompany an artery.

    ______j. Veins never have the same name as a corresponding artery.

Written Test

24. Complete the following statements concerning the characteristics of capillaries by circling the correct answers.

    a. Are (large, minute) hair-like vessels

    b. Are (one, five) layer(s) in thickness

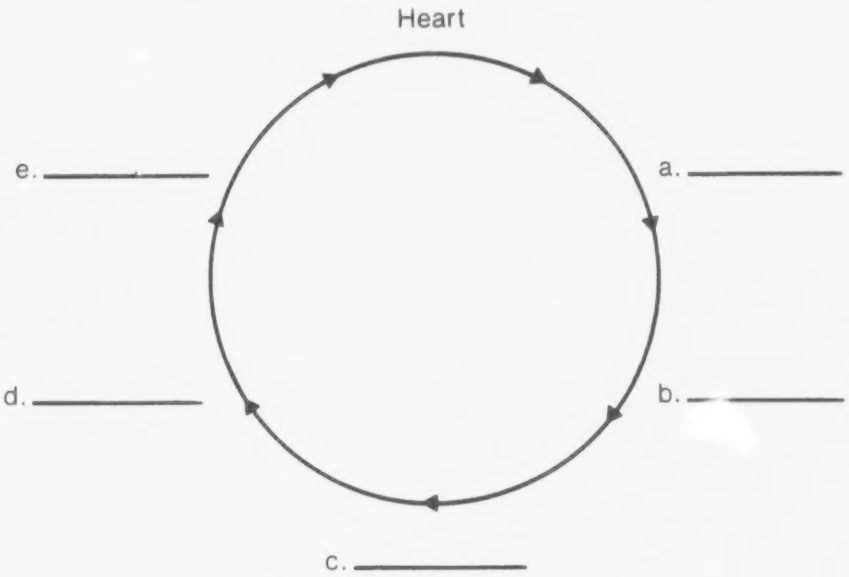
    c. Connect arterioles and (arteries, venules)

    d. Transport nutrients to the cells and carry wastes away from cells through (osmosis, phagocytosis)

    e. One square inch of muscle has 1½ (thousand, million) capillaries.

    f. Red blood cells flow through the capillaries in (single file, clots).

25. Complete the following illustration of the circulation of blood through vessels.



Written Test

26. Distinguish between the types of circulation by placing an "X" next to the description(s) of pulmonary circulation.

_____a. Is the circulation of blood from the right ventricle of the heart to the lungs and back to the left atrium of the heart

_____b. Is the circulation of blood from the right ventricle of the heart to all parts of the body and back to the right atrium of the heart

_____c. Function is to carry oxygen and nutritive materials to all body tissues and to remove products of metabolism

_____d. Function is to carry deoxygenated blood to the lungs to be reoxygenated and to remove the metabolic waste product of carbon dioxide

27. Complete the following statements concerning the major components of pulmonary circulation by filling in the blanks with the correct answers.

a. The _______________ is the trunk artery for pulmonary circulation.

b. Normal pulmonary circulation is as follows:

_______________ → pulmonary artery → lung capillaries → pulmonary veins → _______________

c. The capillaries surrounding the air sacs of the lungs receive a fresh supply of oxygen and release _______________ and moisture.

28. Distinguish between the parts of the aorta by placing the following letters in the appropriate blanks: "AA" for ascending aorta, "DA" for descending aorta, and "ARCH" for aortic arch.

_____a. Ends near the fourth lumbar vertebra at the aortic bifurcation where it branches into the right and left common iliac arteries

_____b. Part that begins at the left ventricle and passes upward

_____c. Has two branches, the left and right coronary arteries

_____d. Part that turns backward and to the left at about the level of the fourth thoracic vertebra

_____e. Has three major branches

_____f. Part that passes downward

Written Test

29. Match the major arteries of systemic circulation of the right with the correct areas they supply.

______ a. Supply myocardium
______ b. Supplies right arm and surrounding area
______ c. Supplies left arm and surrounding area
______ d. Supplies left side of head, neck, and brain
______ e. Supply bronchi
______ f. Supply esophagus
______ g. Supply pericardium
______ h. Supply intercostal areas
______ i. Supply lymph glands and posterior mediastinum
______ j. Supply diaphragm
______ k. Supplies stomach, liver, and spleen
______ l. Supplies all of small intestine except the superior portion of the duodenum
______ m. Supplies all of colon and rectum except right half of transverse colon
______ n. Supply adrenal glands
______ o. Supply kidneys, ureters, and adrenals
______ p. Supply testicles and ureter
______ q. Supply ovaries, part of ureters, and uterine tubes
______ r. Supply diaphragm and esophagus
______ s. Supply lumbar and psoas muscles and part of abdominal wall musculature
______ t. Supplies sacrum and coccyx

1. Bronchial
2. Celiac
3. Left common carotid
4. Coronary (R and L)
5. Esophageal
6. External iliac
7. Internal iliac
8. Intercostal
9. Lumbar
10. Mediastinal
11. Inferior mesenteric
12. Superior mesenteric
13. Ovarian
14. Pericardial
15. Inferior phrenic
16. Superior phrenic
17. Renal
18. Middle sacral
19. Left subclavian
20. Right subclavian
21. Middle suprarenal
22. Testicular

Written Test

30. Match the major veins of systemic circulation of the right with the correct areas they drain.

______a. Drains blood from upper half of body; one of the two large trunk veins of systemic circulation

______b. Returns blood from lower half of body; one of the two large trunk veins of systemic circulation

______c. Draw blood from head, neck, and upper extremities; unite to form superior vena cava

______d. Main trunk vein that drains upper extremity; joins internal jugular vein to form the innominate vein

______e. Drains axilla region

______f. Collects blood from brain, superficial parts of face, and neck; largest vein of head and neck

______g. Receives greater part of blood from exterior of cranium and deep parts of face

______h. Drains lateral thoracic wall; tributary of axillary vein

______i. Drain surface and wall of stomach

______j. Drain the liver and then empty into the inferior vena cava

______k. Draws blood from spleen and part of stomach

______l. Collects bloods from digestive tract and conveys it to the liver; formed by union of superior mesenteric and splenic veins

______m. Drains blood from small intestine

______n. Drains blood from rectum, sigmoid, and descending parts of colon

______o. Drains the kidneys

______p. Draws blood from pelvis and legs; from inferior vena cava

1. Axillary
2. Femoral
3. Gastric (R, L, and short)
4. Hepatic (R and L)
5. Common iliac (R and L)
6. Innominate (R and L)
7. External jugular
8. Internal jugular
9. Inferior mesenteric
10. Superior mesenteric
11. Portal
12. Renal (R and L)
13. Great saphenous
14. Splenic
15. Subclavian
16. Long thoracic
17. Inferior vena cava
18. Superior vena cava

Written Test

31. Complete the following statements concerning portal circulation by circling the correct answers.

    a. Veins from the (gallbladder, stomach), intestine, spleen, and pancreas empty into one vessel, the portal vein.

    b. Portal vein then carries the blood, loaded with digested food products, to the (heart, liver), where food is altered, stored, and released as needed.

    c. Blood leaves the liver through the (mesenteric, hepatic) veins which empty into the inferior vena cava.

Circulatory System
Unit 9

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

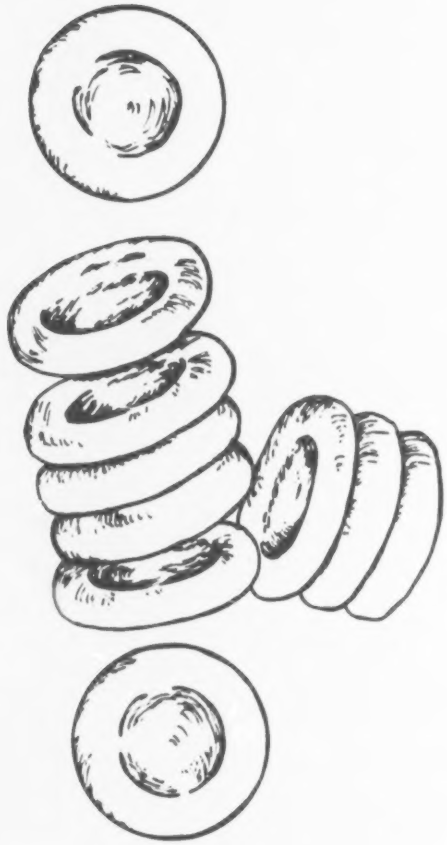
____

Teacher Signature ______________________________ Date __________

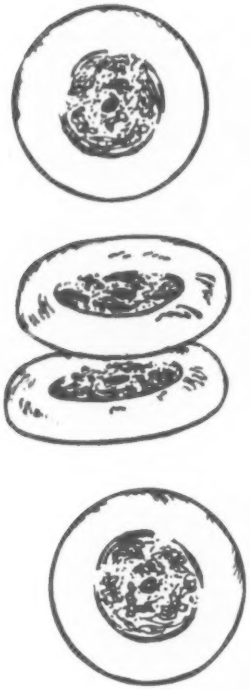
Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.

Red Blood Cells



Mature



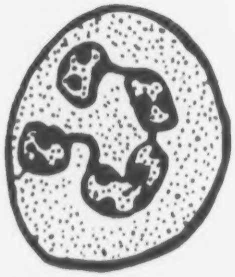
Immature

(Note the nucleation.)

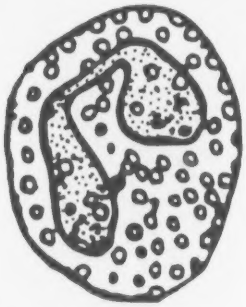
(Note the concave surfaces.)

White Blood Cells and Platelets

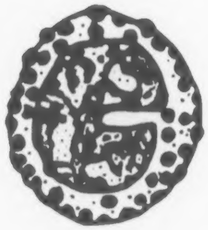
GRANULOCYTES



Neutrophil
(stains neutral
color in tests)

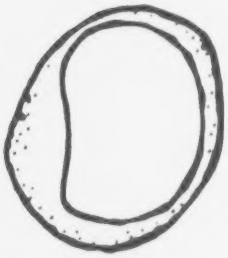


Eosinophil
(stains red)

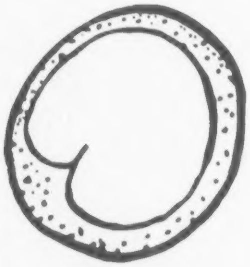


Basophil
(stains deep
blue/purple)

AGRANULOCYTES

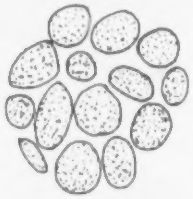


Lymphocyte



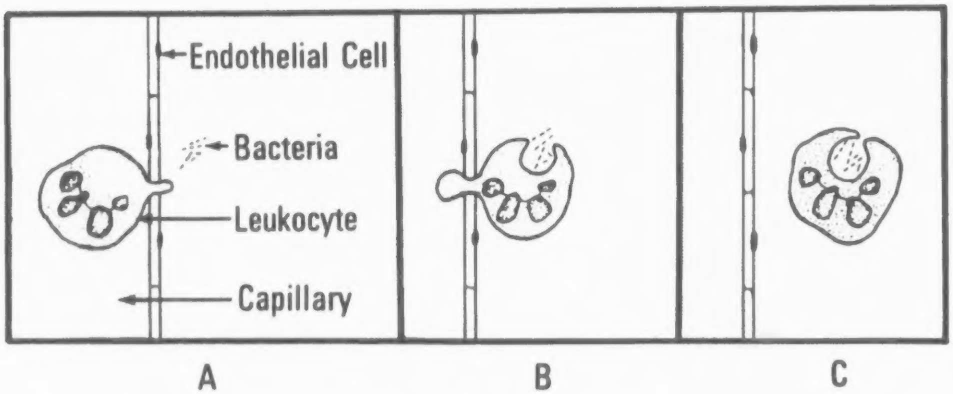
Monocyte

PLATELETS



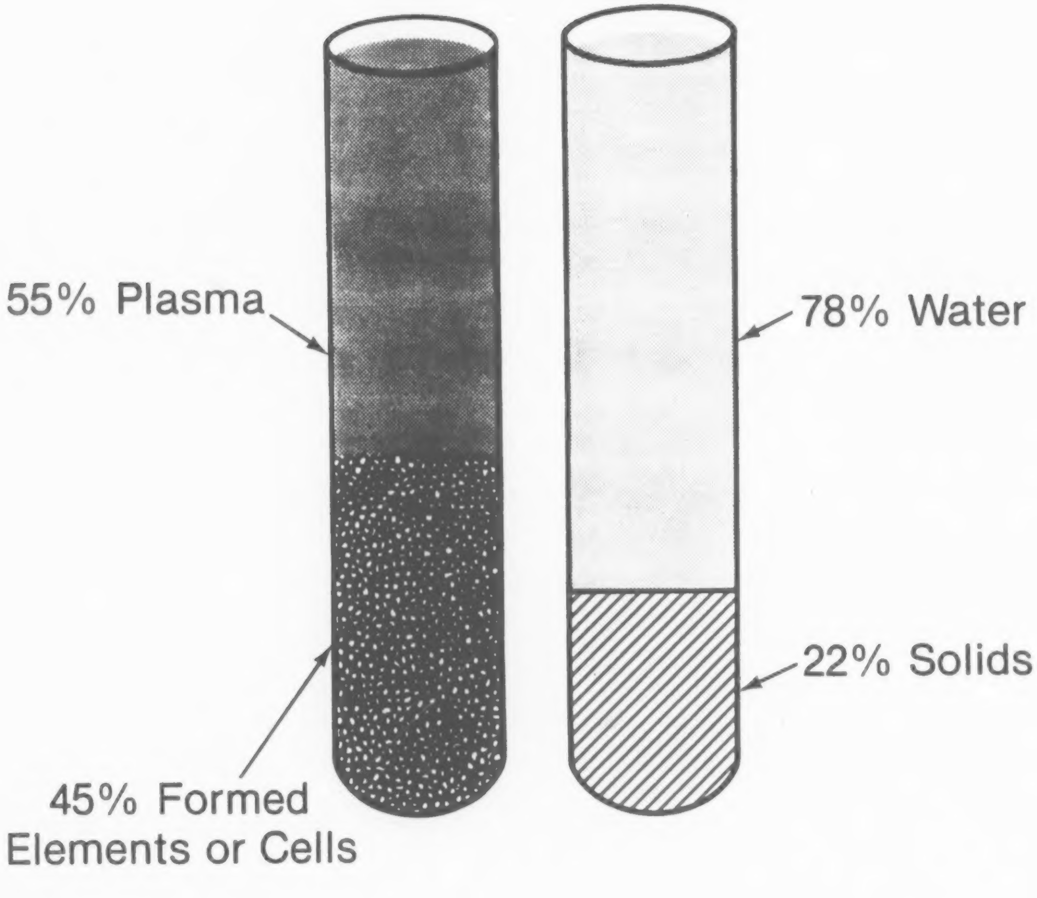
(Thrombocytes)

Ameboid Action of Leukocytes

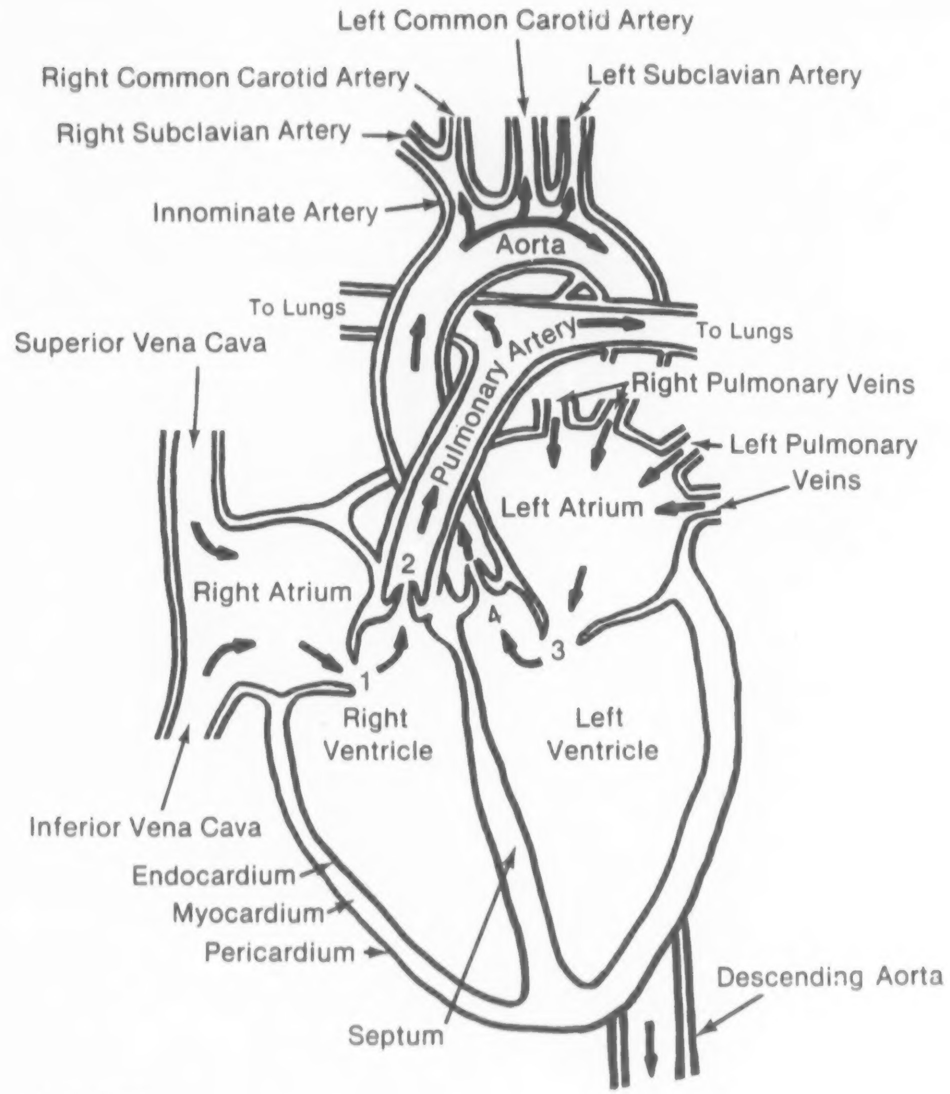

Endothelial Cell
Bacteria
Leukocyte
Capillary
A
B
C

(A) A white blood cell squeezing itself through a capillary wall, in the region of an infection. (B) and (C) The white cell engulfing the bacteria (phagocytosis), part of the body's process of fighting infection.

Composition of Blood


55% Plasma
45% Formed Elements or Cells
78% Water
22% Solids

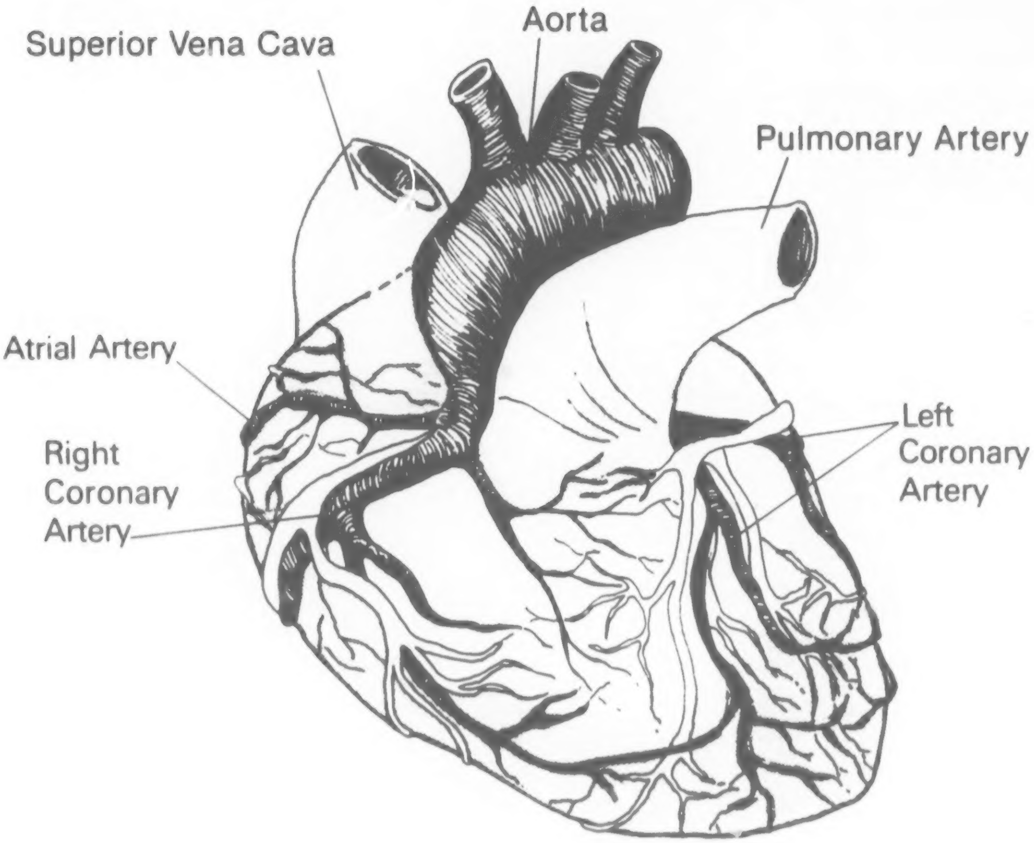
Structure of the Heart


Left Common Carotid Artery
Right Common Carotid Artery
Left Subclavian Artery
Right Subclavian Artery
Innominate Artery
Aorta
To Lungs
To Lungs
Superior Vena Cava
Pulmonary Artery
Right Pulmonary Veins
Left Pulmonary Veins
Left Atrium
Right Atrium
2
4
3
1
Right Ventricle
Left Ventricle
Inferior Vena Cava
Endocardium
Myocardium
Pericardium
Descending Aorta
Septum

VALVES

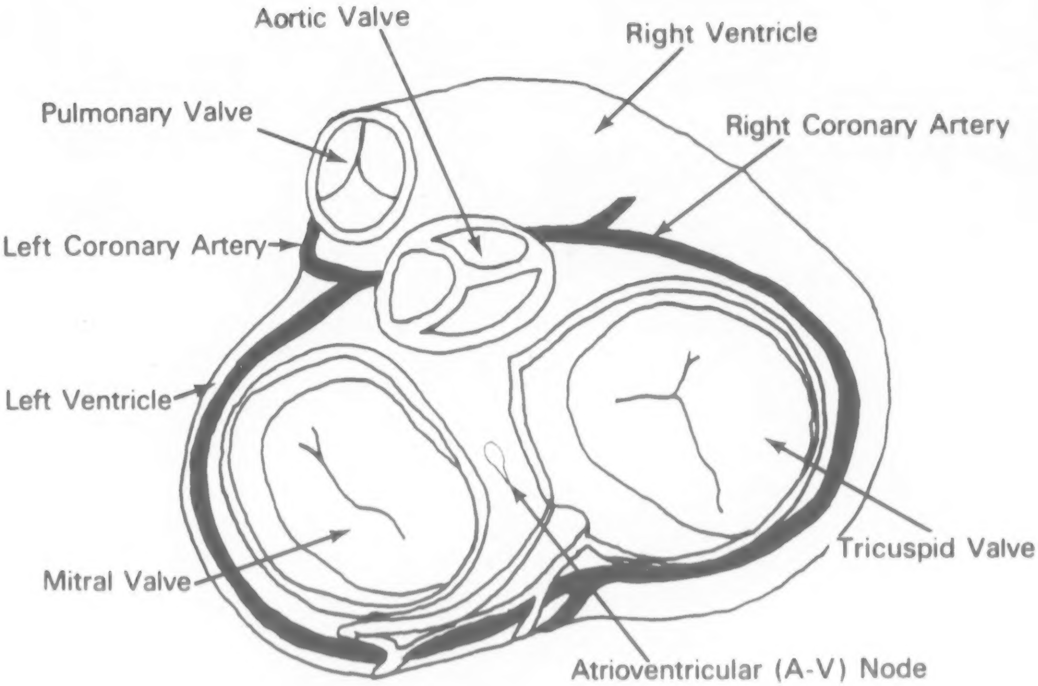
1. Tricuspid
2. Pulmonary Semilunar
3. Bicuspid or Mitral
4. Aortic Semilunar

Blood Supply to the Heart


Superior Vena Cava
Aorta
Pulmonary Artery
Atrial Artery
Right Coronary Artery
Left Coronary Artery

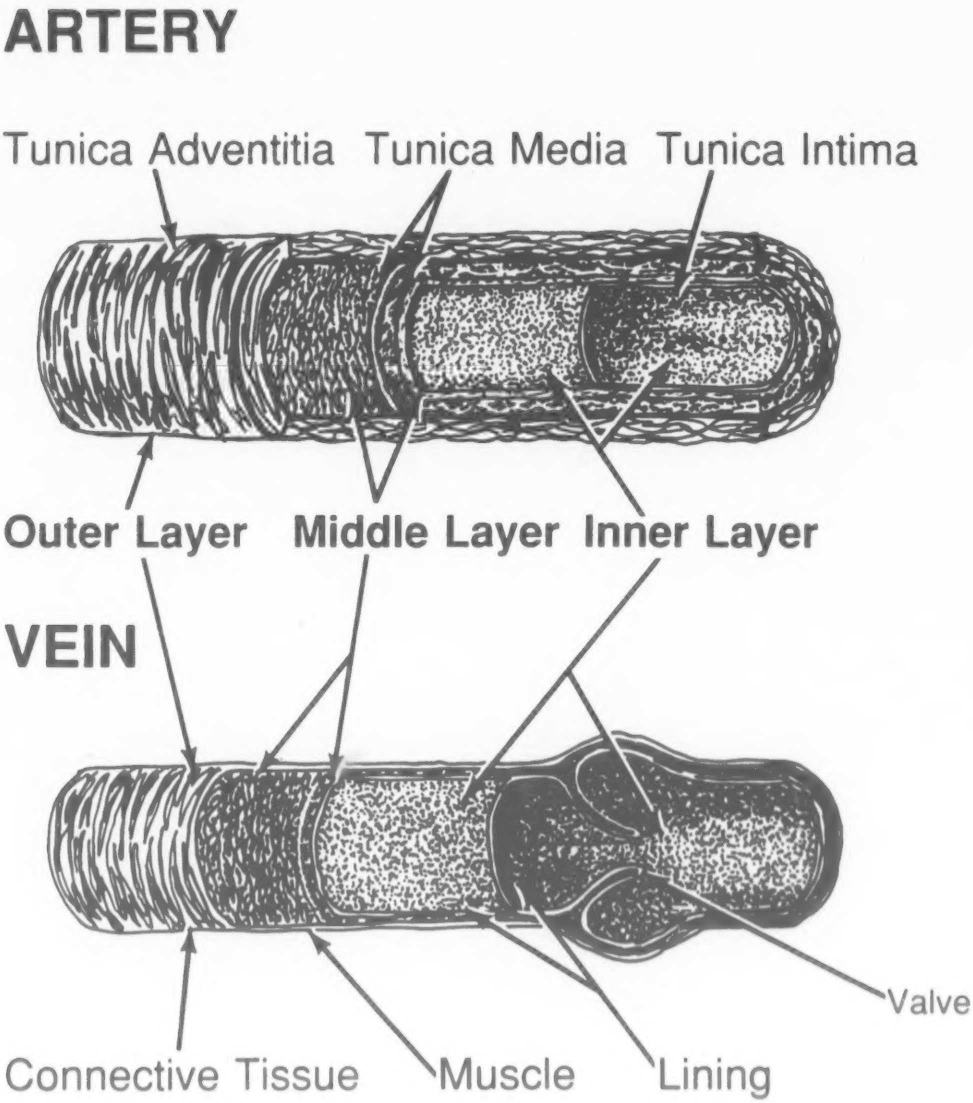
(Coronary arteries surround the heart)

Coronary Arteries

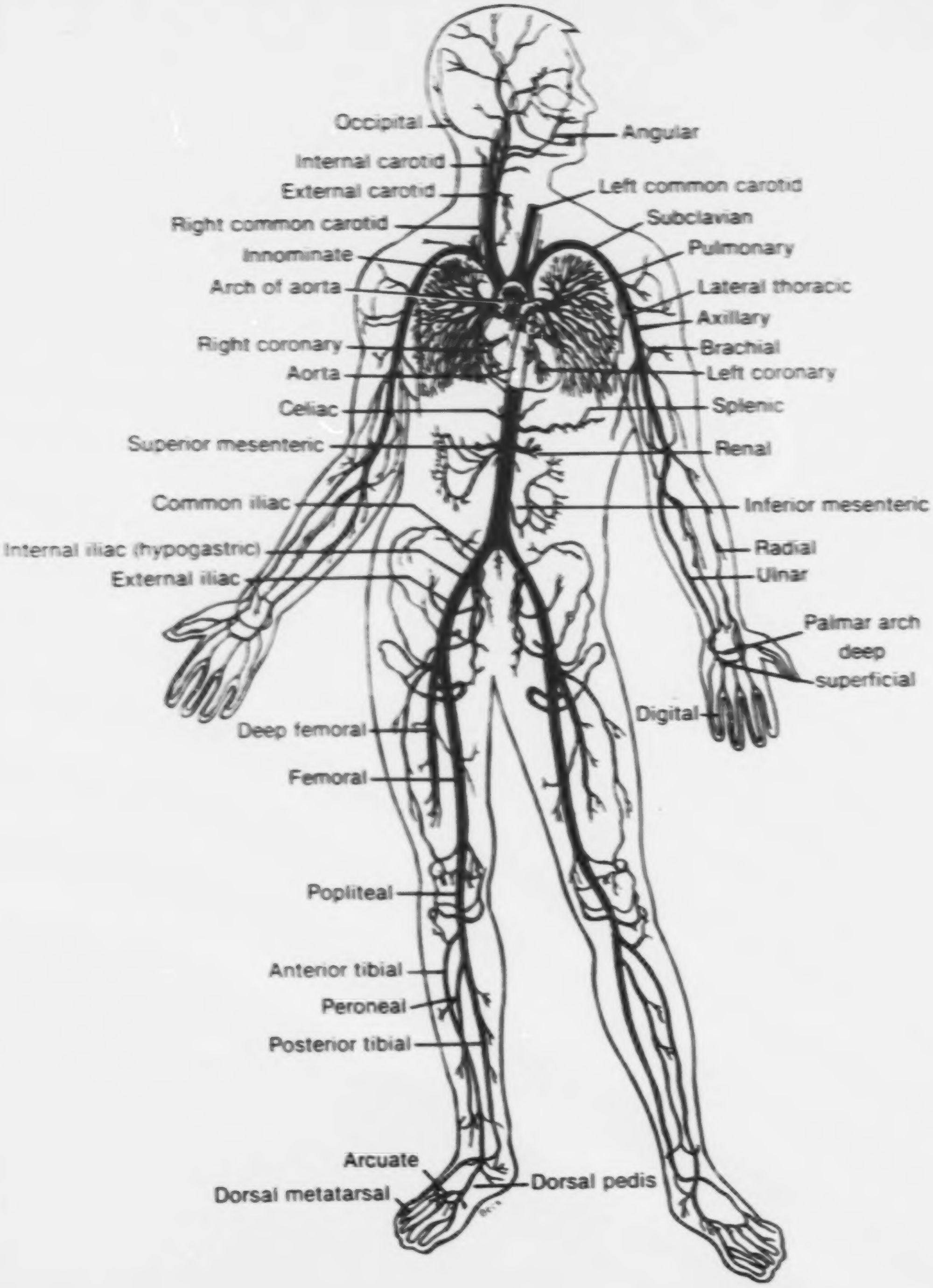

Aortic Valve
Right Ventricle
Pulmonary Valve
Right Coronary Artery
Left Coronary Artery
Left Ventricle
Mitral Valve
Tricuspid Valve
Atrioventricular (A-V) Node

TOP VIEW OF HEART

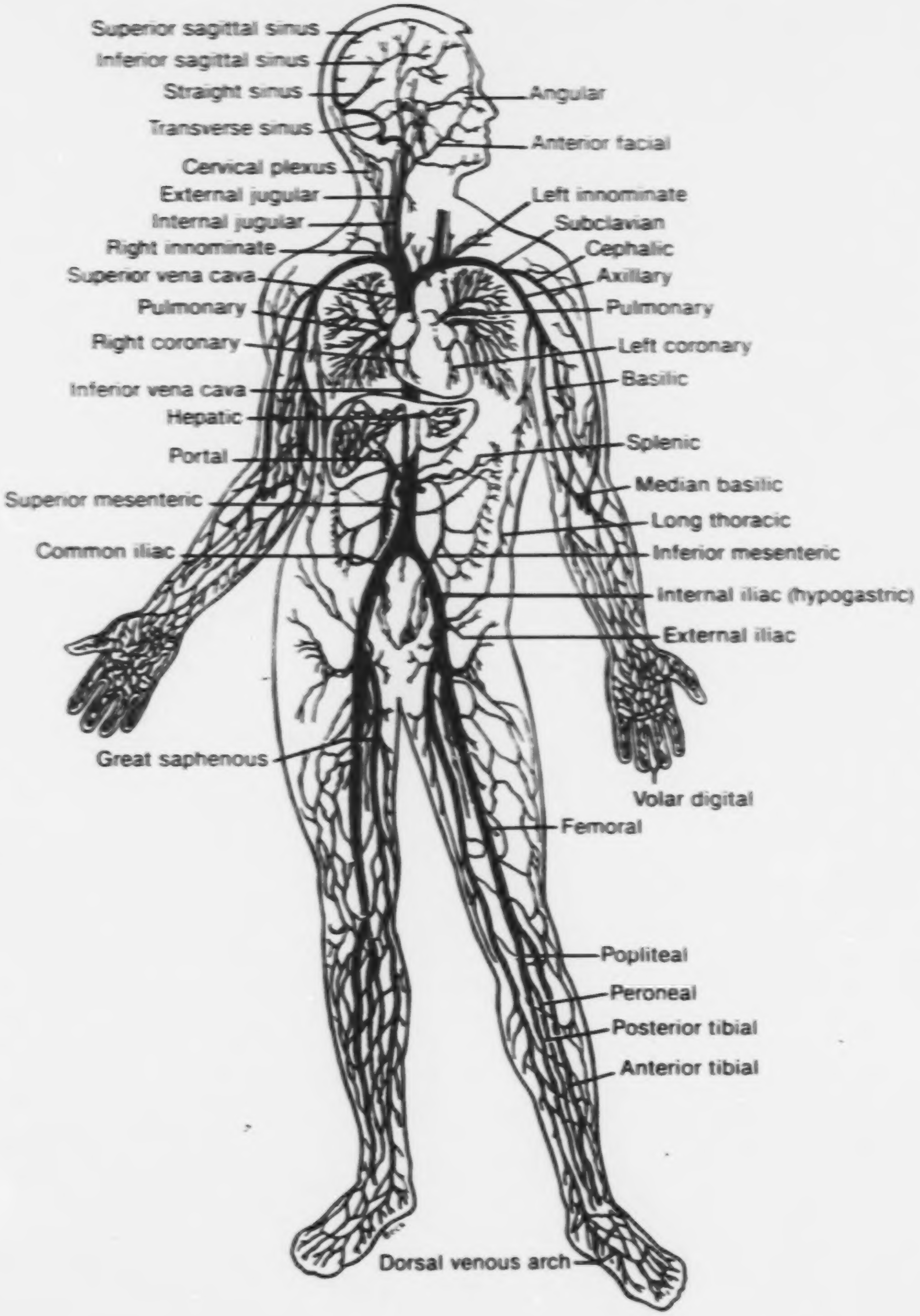
Blood Vessels


ARTERY
Tunica Adventitia
Tunica Media
Tunica Intima
Outer Layer
Middle Layer
Inner Layer
VEIN
Valve
Connective Tissue
Muscle
Lining

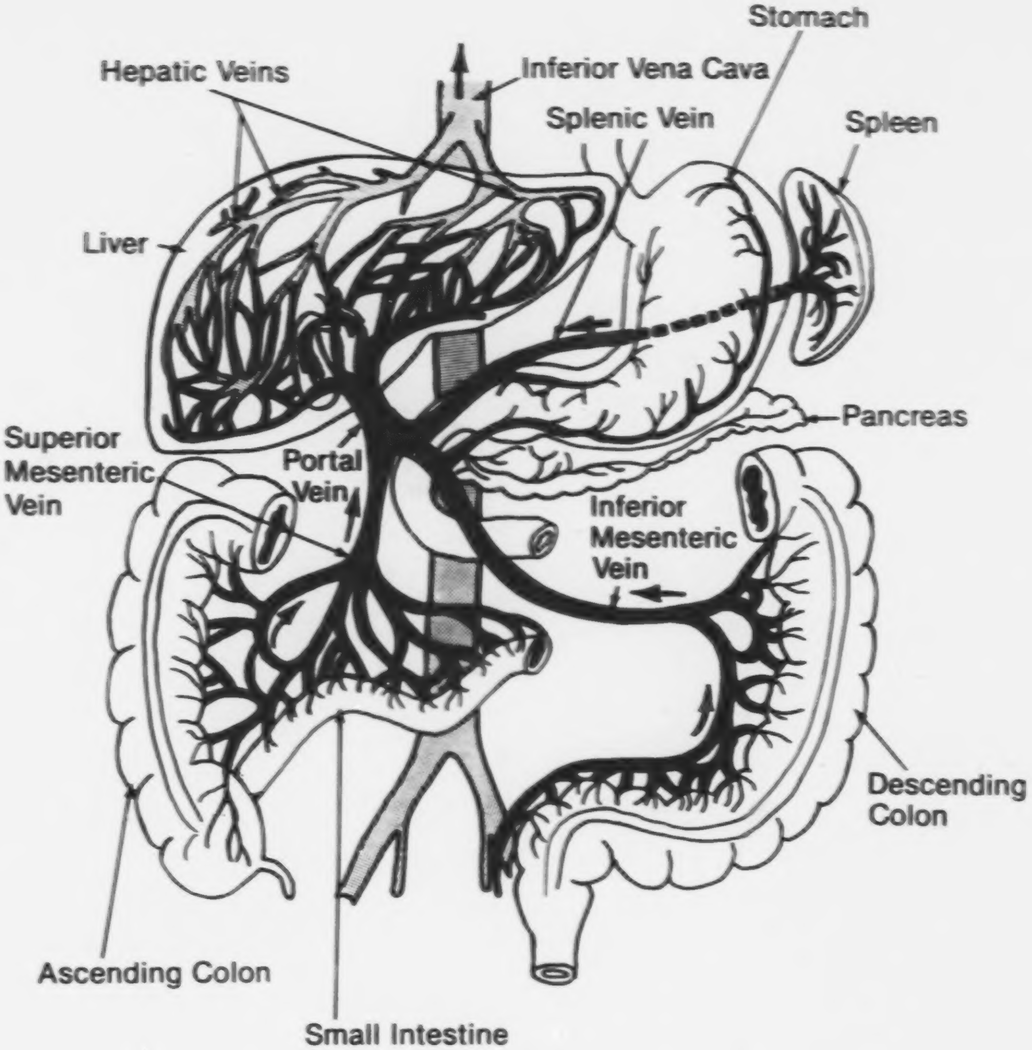
Principal Arteries


Occipital
Angular
Internal carotid
External carotid
Left common carotid
Right common carotid
Subclavian
Innominate
Pulmonary
Arch of aorta
Lateral thoracic
Axillary
Right coronary
Brachial
Aorta
Left coronary
Celiac
Splenic
Superior mesenteric
Renal
Common iliac
Inferior mesenteric
Internal iliac (hypogastric)
Radial
External iliac
Ulnar
Palmar arch
deep
superficial
Digital
Deep femoral
Femoral
Popliteal
Anterior tibial
Peroneal
Posterior tibial
Arcuate
Dorsal metatarsal
Dorsal pedis

Principal Veins


Superior sagittal sinus
Inferior sagittal sinus
Straight sinus
Transverse sinus
Cervical plexus
External jugular
Internal jugular
Right innominate
Superior vena cava
Pulmonary
Right coronary
Inferior vena cava
Hepatic
Portal
Superior mesenteric
Common iliac
Great saphenous
Angular
Anterior facial
Left innominate
Subclavian
Cephalic
Axillary
Pulmonary
Left coronary
Basilic
Splenic
Median basilic
Long thoracic
Inferior mesenteric
Internal iliac (hypogastric)
External iliac
Volar digital
Femoral
Popliteal
Peroneal
Posterior tibial
Anterior tibial
Dorsal venous arch

Portal Circulation


Stomach
Hepatic Veins
Inferior Vena Cava
Splenic Vein
Spleen
Liver
Pancreas
Superior Mesenteric Vein
Portal Vein
Inferior Mesenteric Vein
Descending Colon
Ascending Colon
Small Intestine

Circulatory System
Unit 9

Information Sheet

1. Terms and definitions

    a. **Blood** — The fluid that circulates through the heart and the blood vessels

    b. **Cardiac** — Pertaining to the heart

    c. **Cardiology** — The study of the heart

    d. **Circulatory system** — The system through which the nutrient fluids of the body circulate

    e. **Coagulation** — The process of clotting

    f. **Embolus** — A clot or other plug, usually part or all of a thrombus, brought by the blood from another vessel and forced into a smaller one, thus obstructing circulation

    g. **Gamma globulin** — A protein formed in the blood which is related to the ability to resist infection

    h. **Hematology** — The science concerned with blood and the blood-forming tissues

    i. **Hemoglobin** — The iron-containing pigment of the red blood cells

    j. **Hemolysis** — The destruction of red blood cells with liberation of hemoglobin into the surrounding fluid

    k. **Hemophilia** — A sex-linked hereditary blood disease in which blood fails to clot and abnormal bleeding occurs

    l. **Hemorrhage** — Abnormal internal or external bleeding

    m. **Hemostasis** — Arrest of bleeding or of circulation

    n. **Homeostasis** — State of equilibrium of the internal environment

    o. **Peripheral** — Pertaining to the outer part or surface of the body; part away from the center

    p. **Phlebitis** — Inflammation of a vein, especially in the veins of the lower limbs

    q. **Pulmonary** — Involving the lungs

Information Sheet

r. **Systemic** — Pertaining to the whole body rather than to one of its parts

s. **Thrombus** — A solid mass formed in the living heart or vessels from constituents of the blood; attached to the wall of the vessel

t. **Transfusion** — Injection of the blood of one person into the blood vessels of another

u. **Varicose veins** — Swollen, distended, and knotted veins, usually in the subcutaneous tissues of the leg

v. **Vasoconstriction** — Narrowing the caliber of blood vessels

w. **Vasodilation** — Widening of blood vessels

2. **Functions of the circulatory system**

   a. Transports various substances to and from body cells such as O_2, CO_2, food, water, chemicals, hormones, and wastes

   b. Protects body against invading microorganisms

   c. Helps regulate body temperature

   d. Maintains homeostasis

   e. Transports waste products to excretory organs

3. **Organs of the circulatory system**

   a. **Heart** — Pumps blood into the arteries

   b. **Blood vessels** — Carry blood to and from the heart, and thus carry oxygen and nutritive materials to the body and remove products of metabolism

   c. **Red bone marrow** — Forms blood cells and hemoglobin

   d. **Lymphatic vessels and nodes** — Carry lymph and tissue fluid, help to filter the blood, and manufacture lymphocytes

   e. **Spleen** — Forms lymphocytes and monocytes, stores blood cells, and filters out bacteria and worn-out red blood cells

   Note: The lymphathic system will be discussed in more detail in the next unit (Unit 10). It includes the lymphatic vessels and spleen listed above. The circulatory system and the lymphatic system are interconnected because they both move body fluids.

Information Sheet

4. **Constituents of blood and their functions**

    a. **Blood plasma** — Liquid part of blood which serves as a source of nutrition and a means of removing waste products from the body cells

    b. **Blood cells** — Formed-elements part of blood

        (1) Red blood cells (RBC) — Transport respiratory gases CO_2 and O_2

        (2) White blood cells (WBC) — Ingest and digest foreign particles in blood, form antibodies, and release heparin which prevents intravascular clotting

        (3) Blood platelets — Initiate blood clotting

5. **Characteristics of red blood cells** (Figure 1)

Note: Red blood cells are also called red corpuscles, RBC, and erythrocytes.

a. Appearance and size

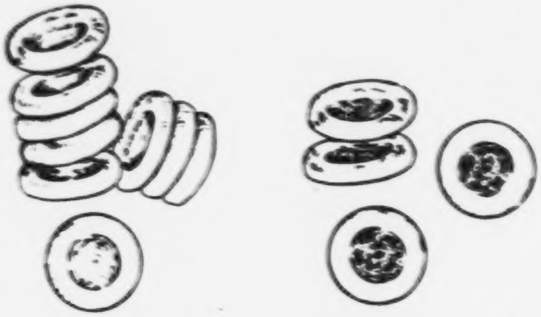
(1) Red, minute, disk-shaped cells with central area thinner than the edges (concave)

(2) Very flexible and elastic

(3) 3000 red blood cells side-by-side are equal to one inch in length.

(4) Mature cells contain no nucleus; therefore, no further growth occurs.

Figure 1



Mature

Immature

(Note the nucleation.)

b. Function

(1) Transport respiratory gases (CO_2 and O_2)

(2) Hemoglobin is the oxygen-carrying red pigment of the red blood cell.

(3) Hemoglobin is composed of iron and protein.

c. Formation

(1) Formed in red bone marrow in skull, vertebrae, ribs, sternum, and proximal epiphysis of femur and humerus

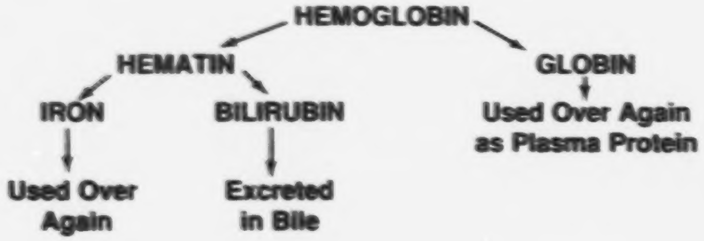
(2) Formed continually, millions every hour

d. Destruction

(1) Life span is 120 days.

(2) Break apart or rupture in the capillaries of the liver and/or the spleen.

(3) Liver breaks down the fragments.


HEMOGLOBIN
HEMATIN
GLOBIN
IRON
BILIRUBIN
Used Over Again as Plasma Protein
Used Over Again
Excreted in Bile

(4) Can also be destroyed by abnormal stress

(a) Mechanical destruction, as when taking blood from a vein
(b) Hemolysis—Hypotonic solutions cause cells to rupture.
(c) Crenation—Hypertonic solutions cause cells to shrink and shrivel.

Information Sheet

e. Laboratory tests

Note: The following figures are average and will vary.

(1) Erythrocyte (RBC) count: 4½ - 5½ million/cu. mm.

(2) Hematocrit count: Percentage count of total blood volume composed of RBC

(a) 42 - 50% in men
(b) 40 - 48% in women

(3) Hemoglobin: The amount of hemoglobin expressed in grams per 100 ml. of blood

(a) Male: 14 - 18 gm/100 ml
(b) Female: 12 - 16 gm/100 ml

(4) Reticulocyte count: Give information about the red cell production rate

6. **Characteristics of white blood cells** (Figure 2)

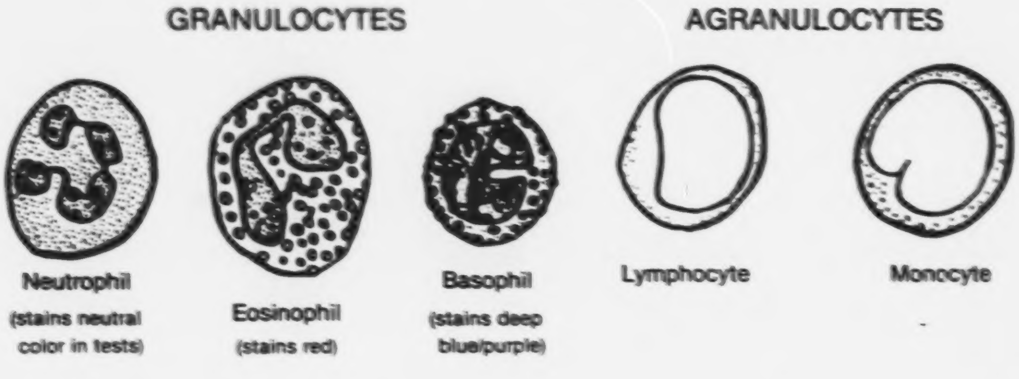
Note: White blood cells are also called white corpuscles, WBC, and leukocytes.

a. Appearance and size

(1) Colorless, ameboid-like cells

(2) Nuclei vary in shape depending on the type of leukocyte.

Figure 2


GRANULOCYTES
AGRANULOCYTES
Neutrophil
(stains neutral color in tests)
Eosinophil
(stains red)
Basophil
(stains deep blue/purple)
Lymphocyte
Monocyte

Information Sheet

b. Types

(1) Neutrophils: 60-70% of all white blood cells

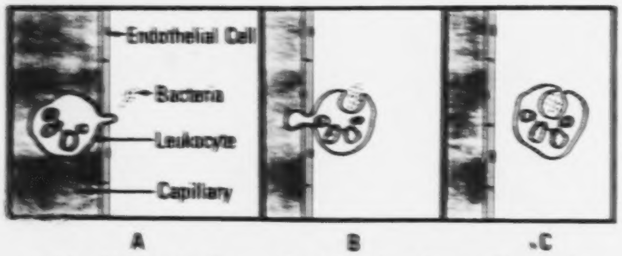
(2) Lymphocytes: 20-30% of all white blood cells

(3) Monocytes
(4) Basophils — Trace amounts
(5) Eosinophils

c. Functions

(1) Phagocytosis

Figure 3



(A) A white blood cell squeezing itself through a capillary wall, in the region of an infection. (B) and (C) The white cell engulfing the bacteria (phagocytosis), part of the body's process of fighting infection.

(2) Formation of antibodies by lymphocytes

(3) Release of heparin by basophils

d. Formation

(1) Neutrophils, eosinophils, and basophils are formed in the red bone marrow.

(2) Lymphocytes are formed in lymph nodes.

(3) Monocytes are formed in cells lining the capillaries in various organs, especially spleen.

e. Life span is 1 - 12 days.

f. Laboratory test — Leukocyte count (WBC) — 5,000 - 10,000/cu. mm.

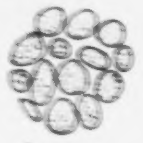
Note: Elevation usually indicates infection or a pathological condition.

Information Sheet

7. **Characteristics of platelets (Thrombocytes)** (Figure 4)

   a. Appearance — Round or oval disks

   Figure 4



   b. Function — Initiate clotting mechanism

   c. Formation — Red bone marrow

   d. Laboratory test — Platelet count — 200,000 - 500,000/cu. mm.

   e. Life span — 1 to 4 days

8. **Physical characteristics of blood**

   a. Color

      (1) Unoxygenated blood carried by veins is purple or deep red.

      (2) Oxygenated blood carried by arteries is bright red

   b. Taste — Slightly metallic and salty

   c. Reaction — Slightly alkaline, pH 7.35 - 7.45

   d. Specific gravity — 1.050 - 1.065 (slightly heavier than water)

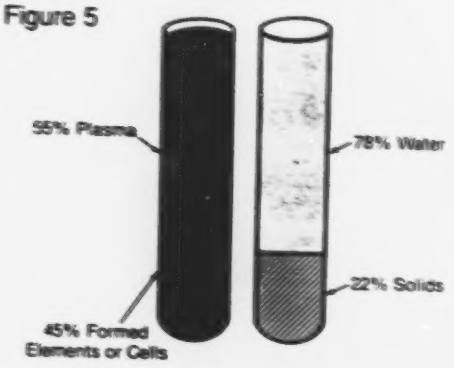
   e. Amount — Varies with weight and sex of the individual but the average total is 5,000 to 5,500 cc. in average plasma.

   f. Consistency

      (1) 45% cells, 55% plasma

      (2) 78% water, 22% solids

Figure 5



9. **Composition of blood plasma**

   a. Water - 90%

   b. Solutes - 10%

      (1) Electrolytes — Mineral salts

      (2) Nutrients — Glucose, amino acids, fats

      (3) Metabolic wastes — Urea, uric acid, creatinine, lactic acid

      (4) Respiratory gases — O_2, CO_2

      (5) Regulatory substance — Hormones, enzymes

      (6) Protective substances — Antibodies

10. **Rh factor**

    a. About 85% of all individuals have another red cell protein (antigen) called Rh factor and are "Rh positive" (+).

    b. About 15% of all individuals do not have this protein (antigen) and are "Rh negative" (–).

    c. When Rh positive blood is given to an Rh negative person, the recipient can produce counteracting proteins called antibodies, which will destroy erythrocytes from Rh positive blood.

    d. An Rh negative mother may become sensitized by proteins from an Rh positive baby.

    Note: The Rh positive factor in the baby would be inherited from the father.

    e. During a later pregnancy, the mother's antibodies may pass into the blood of the unborn infant and cause erythroblastosis fetalis, a destruction of the baby's erythrocytes. The baby would require a complete blood replacement with Rh negative blood.

Information Sheet

11. **Four blood groups (types)**

Note: All of the following groups also have either the Rh positive (+) or Rh negative (-) factor.

a. Type O (+ or –)

   (1) 45% incidence

   (2) Donates to types A, B, AB, O

   (3) Called the universal donor

   (4) Receives type O

b. Type A (+ or –)

   (1) 41% incidence

   (2) Donates to types A and AB

   (3) Receives types A and O

c. Type B (+ or –)

   (1) 10% incidence

   (2) Donates to types B and AB

   (3) Receives types B and O

d. Type AB (+ or –)

   (1) 4% incidence

   (2) Donates to type AB

   (3) Receives types A, B, AB, and O

   (4) Called the universal recipient

Information Sheet

12. Blood clotting mechanism

a. When cells are injured, platelets release thromboplastin.

b. Liver releases prothrombin and fibrinogen.

c. Prothrombin and thromboplastin form thrombin.

d. Thrombin plus fibrinogen form fibrin, a network of fine threads which catch red blood cells.

e. Network becomes a blood clot, called a thrombus.

Note: Rough areas in vessels or slow circulation hastens clotting, whereas, absence of any ingredient necessary for clotting or presence of some drugs delays clotting. Antithrombin and heparin safeguard against unnecessary blood clotting in intact vessels.

13. Structure of the heart (Figure 6)

a. Is a four-chambered, hollow, muscular organ, shaped roughly like a man's closed fist

b. Weighs 250 - 350 grams

c. Lies in the mediastinum suspended by the great vessels with approximately two-thirds of its mass to the left of the midline of the body

d. Is placed in the body in an oblique position with the right side almost in front of the left

e. Lower border is called the apex and lies on the diaphragm pointing to the left.

f. Upper border is called the base and lies below the 2nd rib.

g. Is divided into four chambers

(1) Septum goes from base to apex to divide into right and left halves.

Note: The foramen ovale is the opening between the right and left atria found in the fetus before birth. This closes soon after birth, and thereafter, the two sides do not communicate.

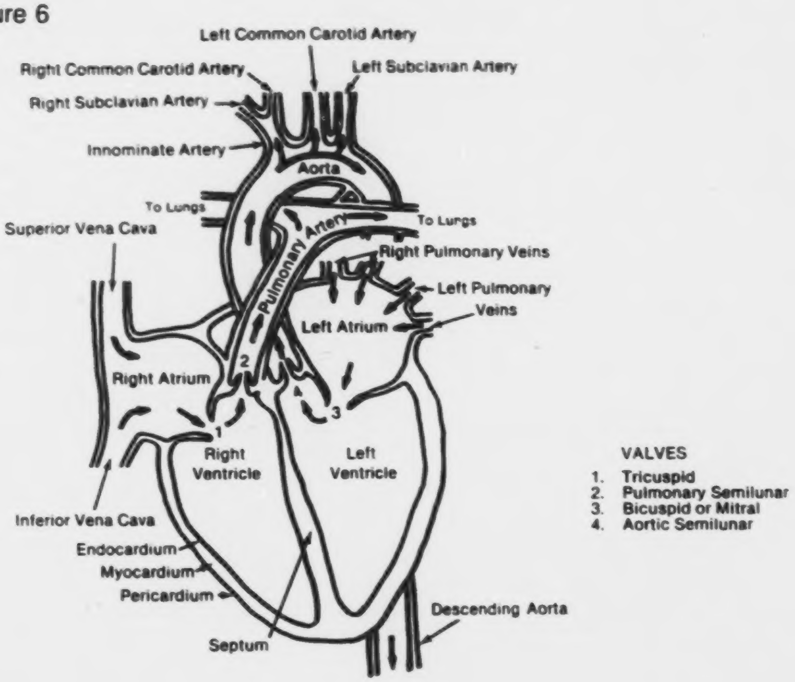
(2) Right half contains venous blood, and left half contains arterial blood.

(3) Halves are divided by valves into upper and lower resulting in four chambers (two upper and two lower).

Information Sheet

h. Is composed of three distinct layers—epicardium, myocardium, and endocardium.

Figure 6


Left Common Carotid Artery
Right Common Carotid Artery
Left Subclavian Artery
Right Subclavian Artery
Innominate Artery
Aorta
To Lungs
Superior Vena Cava
Pulmonary Artery
To Lungs
Right Pulmonary Veins
Left Pulmonary Veins
Left Atrium
Right Atrium
2
4
1
3
Right Ventricle
Left Ventricle
Inferior Vena Cava
Endocardium
Myocardium
Pericardium
Septum
Descending Aorta
VALVES
1. Tricuspid
2. Pulmonary Semilunar
3. Bicuspid or Mitral
4. Aortic Semilunar

14. Covering of the heart

a. The heart is covered by the pericardium.

b. The pericardium consists of two parts

  (1) Parietal pericardium — Outer fibrous layer which forms the loose fitting sac in which the heart lies

  (2) Visceral pericardium (Epicardium) — Inner serous layer (the outer layer of the heart itself)

c. The pericardial space (cavity) lies between the two layers.

d. Serous fluid fills the pericardial space.

e. An excessive amount of fluid in the pericardial space is called pericardial effusion.

f. The pericardium provides a completely enclosed and protective sac in which the heart lies.

g. Inflammation of the pericardium is called pericarditis.

Information Sheet

15. **Layers of the heart**

    a. **Epicardium** (Visceral pericardium) — Serous membrane adherent to the outside

    b. **Myocardium** — Main substance of the heart, specially constructed of cardiac muscle tissue; contracts to decrease the size of the heart and force blood out of its chambers

    c. **Endocardium** — Lines the inner surface of the chambers of the heart, and covers the valves within the heart

16. **Chambers of the heart** (Figure 6)

    a. **Atria (auricles)** — Upper chambers, receiving chambers (2)

       (1) Right atrium (RA) — Receives deoxygenated blood

       (2) Left atrium (LA) — Receives oxygenated blood

    b. **Ventricles** — Lower chambers, pumping chambers (2)

       (1) Right ventricle (RV) — Pumps deoxygenated blood to lungs

       (2) Left ventricle (LV) — Pumps oxygenated blood to tissue

       Note: The ventricles are thicker than the atria, and the left ventricle is three times as thick as the right because it is pushing blood to the rest of the body.

17. **Valves of the heart** (Figure 6)

    Note: These work in one direction only.

    a. **Atrio-ventricular valves**

       (1) Tricuspid valve

          (a) Lies between right atrium and right ventricle
          (b) Named for its three flaps or cusps
          (c) Valve flaps are attached to chordae tendinae which prevent flaps from turning back into the atrium.

       (2) Bicuspid or mitral valve

          (a) Lies between left atrium and left ventricle
          (b) Named for its two flaps or cusps
          (c) Valve flaps are attached to chordae tendinae.
          (d) Is much stronger and thicker than tricuspid valve

Information Sheet

b. **Semilunar valves** — Consist of three half-moon shaped flaps

  (1) Pulmonary semilunar valve — Lies between the right ventricle and the pulmonary artery

  (2) Aortic semilunar valve — Lies between the left ventricle and the aorta

18. **Orifices of the heart — 10 total (Figure 6)**

  a. Opening for superior vena cava into RA

  b. Opening for inferior vena cava into RA

  c. Tricuspid valve orifice between RA and RV

  d. Pulmonary orifice between RV and pulmonary artery

  e. Four openings for pulmonary veins into LA

  f. Bicuspid or mitral valve orifice between LA and LV

  g. Aortic orifice between LV and aorta

19. **Circulation of blood through the heart (Figure 6)**

  Note: The starting place is the superior or inferior vena cava.

  a. Right atrium (deoxygenated blood)

  b. Tricuspid valve

  c. Right ventricle

  d. Pulmonary semilunar valve

  e. Pulmonary artery

  f. Lungs

  g. Pulmonary veins (oxygenated blood)

  h. Left atrium

  i. Bicuspid or mitral valve

  j. Left ventricle

  k. Aortic semilunar valve

  l. Aorta

  Note: At this point the blood leaves the heart.

Information Sheet

20. **Blood supply of the heart** (Figures 7 and 8)

   a. **Coronary arteries, right and left**

      (1) Branch off the aorta

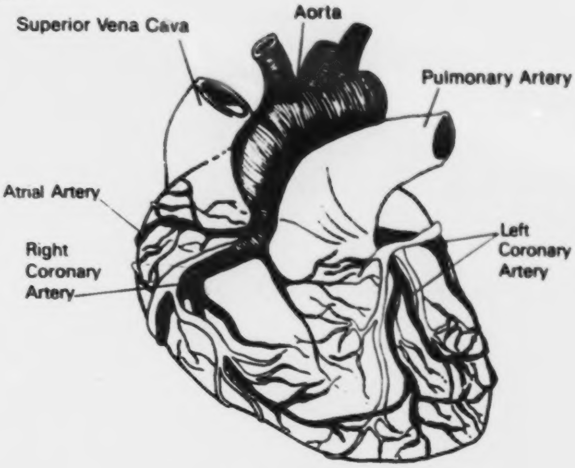
      (2) Encircle the heart like a crown

      (3) Lie in the fatty tissue surrounding the heart

      (4) Supply the myocardial substance of the heart with blood

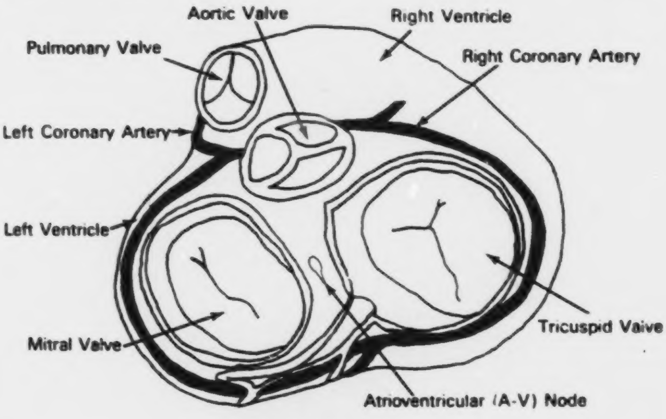
   b. **Coronary veins** — Return the oxygenated blood used by the cardial tissue to the right coronary sinus or directly to the right atrium

Figure 7


Superior Vena Cava
Aorta
Pulmonary Artery
Atrial Artery
Right Coronary Artery
Left Coronary Artery

(Coronary arteries surround the heart)

Figure 8—Top view of heart


Aortic Valve
Right Ventricle
Pulmonary Valve
Right Coronary Artery
Left Coronary Artery
Left Ventricle
Mitral Valve
Tricuspid Valve
Atrioventricular (A-V) Node

TOP VIEW OF HEART

Information Sheet

21. Nerve supply of the heart

a. The heart has two sets of motor nerve fibers.

   (1) One set reaches the heart through the vagus nerve and the craniosacral system.

      (a) Slow or stop the heartbeat
      (b) Called inhibitory nerve fibers

   (2) The other set reaches the heart through the spinal cord and thoracolumbar system.

      (a) Augment or quicken the heartbeat
      (b) Called accelerator or excitatory nerve fibers

b. Both sets of nerves are connected with the cardiac center found in the medulla oblongata.

22. Characteristics of arteries

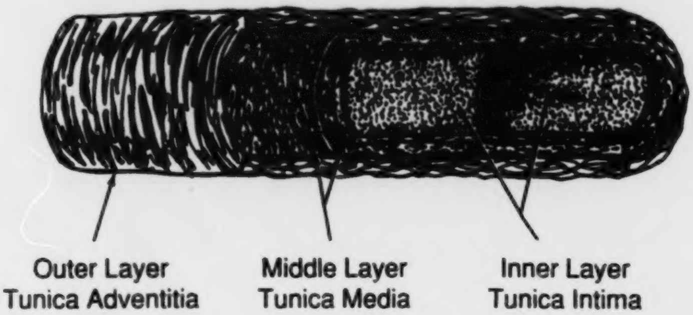
a. Composed of three layers (Figure 9)

   (1) Tunica intima — Inner layer composed of endothelium

   (2) Tunica media — Middle layer composed of involuntary muscle and elastic which permit constriction and dilation

   (3) Tunica adventitia — Outer layer composed of fibrous connective tissue which causes artery to stand open when cut

Figure 9—Artery



b. Carry oxygenated blood away from the heart beginning at the aorta

Note: The exception to this is the pulmonary artery and its branches which carry deoxygenated blood to the lungs to be reoxygenated.

c. Break up into arterioles (small arteries) and capillaries

d. Outer layer of artery is supplied with tiny arteries, capillaries, and veins known as vasa-vasorum or "vessels of vessels."

e. Many arteries are named for their location in the body, but the same artery receives a different name as it proceeds to a new part of the body.

Example: The subclavian artery becomes the axillary artery as it passes through the axilla, and then becomes the brachial artery as it passes through the upper arm. At the elbow it divides into the radial and ulnar arteries.

f. The large trunk artery is the aorta.

   (1) Measures 1¼ inches in diameter at the connection with the heart

   (2) Divides and subdivides into smaller branches

23. Characteristics of veins

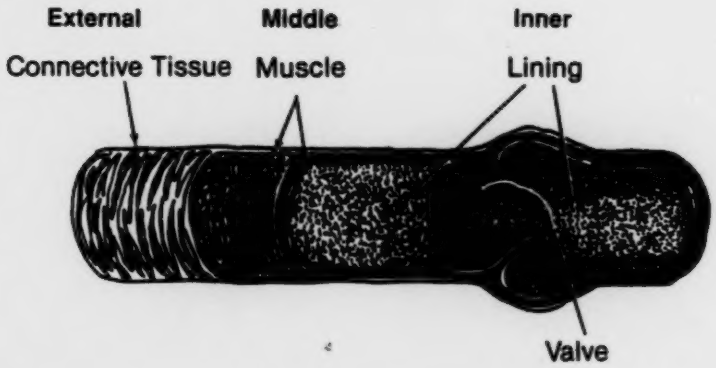
a. Composed of three coats (Figure 10)

   (1) Inner — Endothelial lining

   (2) Middle — Muscular layer

   (3) External — Connective tissue

Figure 10



Information Sheet

b. The walls of veins are much thinner than arterial walls and are easily collapsed when cut.

c. The muscular coats is not as well developed and not as elastic in veins.

d. Many veins are provided with valves to prevent the backflow of blood.

Note: These valves are most numerous in the lower extremities.

e. Carry deoxygenated blood back to the heart

Note: The exception to this is the pulmonary veins which carry oxygenated blood back to the heart.

f. Small veins are known as venules.

g. The two large trunk veins are the superior and inferior vena cava.

h. Two sets of veins are found in most parts of the body.

  (1) Superficial veins are close to the skin.

  (2) Deep veins usually accompany an artery.

i. Veins often have the same name as corresponding arteries.

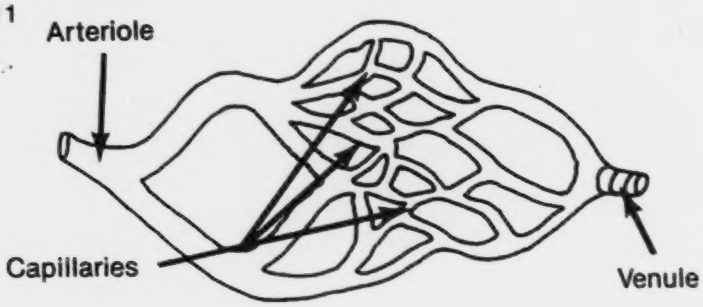
24. **Characteristics of capillaries**

a. Are minute, hair-like vessels

b. Are only one cell layer in thickness

c. Connect arterioles and venules

Figure 11



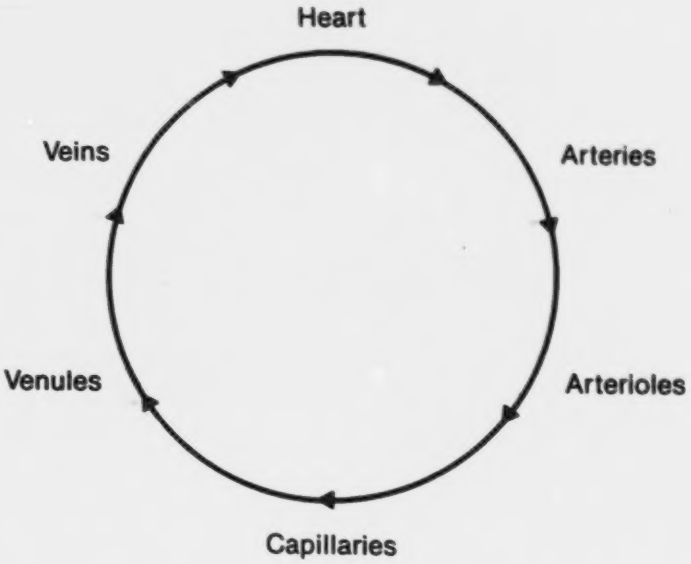
d. Transport nutrients to the cells and carry wastes away from cells through osmosis

e. One square inch of muscle has 1½ million capillaries.

f. Red blood cells flow through the capillaries in single file.

25. Circulation of blood through vessels

Figure 12



26. Types of circulation

a. Pulmonary circulation

(1) Is the circulation of blood from the right ventricle of the heart to the lungs and back to the left atrium of the heart

(2) Function is to carry deoxygenated blood to the lungs to be reoxygenated and to remove the metabolic waste product of carbon dioxide

b. Systemic circulation

(1) Is the circulation of blood from the left ventricle of the heart to all parts of the body and back to the right atrium of the heart

(2) Function is to carry oxygen and nutritive materials to all body tissues and to remove products of metabolism

Information Sheet

27. Major components of pulmonary circulation

a. The pulmonary artery is the trunk artery for pulmonary circulation.

   (1) Begins at the right veritricle

   (2) Divides into the right and left pulmonary artery

   (3) They continue to divide into smaller arteries, then arterioles, and finally form a network of capillaries which surround and supply the air sacs of the lungs.

b. The capillaries surrounding the air sacs of the lungs receive a fresh supply of oxygen and release carbon dioxide and moisture.

   Note: The capillaries are the location of the exchange of oxygen and carbon dioxide and not the lungs' actual blood supply. Separate arteries from branches of the bronchial arteries enter the lung and supply the bronchi and bronchioles with blood.

c. After being reoxygenated, the blood returns to the left atrium, through capillaries, venules, small veins, and finally two right and two left pulmonary veins (4 total)

d. Each pulmonary vein has a separate opening into the left atrium.

e. Normal pulmonary circulation is as follows:

   RV → pulmonary artery → lung capillaries → pulmonary veins → LA

28. Parts of the aorta

a. **Ascending aorta**

   (1) Part that begins at the left ventricle and passes upward

   (2) Has two branches, the left and right coronary arteries

b. **Aortic arch**

   (1) Part that turns backward and to the left at about the level of the fourth thoracic vertebra

   (2) Has three major branches

      (a) Innominate artery which branches into the right subclavian artery and the right common carotid artery
      (b) Left common carotid artery
      (c) Left subclavian artery

c. **Descending aorta**

(1) Part that passes downward

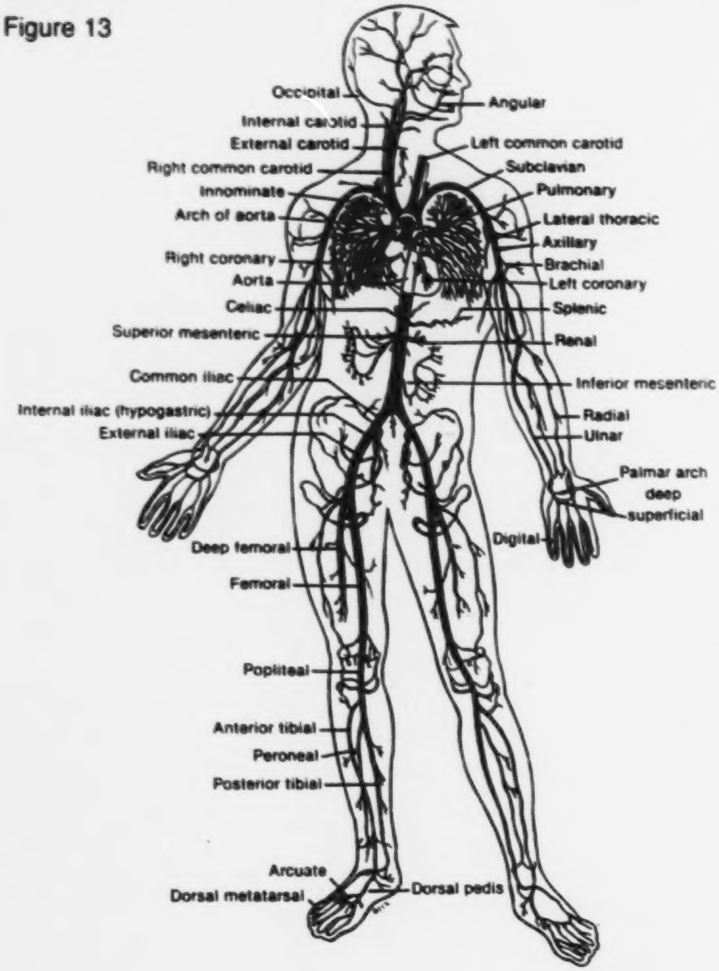
(2) Top portion is called the thoracic aorta and has several branches.

(3) After passing through the diaphragm, it is called the abdominal aorta and has many branches.

(4) Ends near the fourth lumbar vertebra at the aortic bifurcation where it branches into the right and left common iliac arteries (which continue to branch)

29. Major arteries of systemic circulation and areas they supply

Figure 13


Occipital
Internal carotid
External carotid
Right common carotid
Innominate
Arch of aorta
Right coronary
Aorta
Celiac
Superior mesenteric
Common iliac
Internal iliac (hypogastric)
External iliac
Deep femoral
Femoral
Popliteal
Anterior tibial
Peroneal
Posterior tibial
Arcuate
Dorsal metatarsal
Angular
Left common carotid
Subclavian
Pulmonary
Lateral thoracic
Axillary
Brachial
Left coronary
Splenic
Renal
Inferior mesenteric
Radial
Ulnar
Palmar arch
deep
superficial
Digital
Dorsal pedis

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Information Sheet

a. Right and left coronary arteries — Supply myocardium

b. Arteries from aortic arch

   (1) Right subclavian artery — Supplies right arm and surrounding area

   (2) Left subclavian artery — Supplies left arm and surrounding area

   (3) Right common carotid artery — Supplies right side of head, neck, and brain

   (4) Left common carotid artery — Supplies left side of head, neck, and brain

c. Arteries from thoracic aorta

   (1) Bronchial arteries — Supply bronchi

   (2) Esophageal arteries — Supply esophagus

   (3) Pericardial arteries — Supply pericardium

   (4) Intercostal arteries (9 or 10 pairs) — Supply intercostal areas

   (5) Mediastinal branches — Supply lymph glands and posterior mediastinum

   (6) Superior phrenic arteries — Supply diaphragm

d. Arteries from abdominal aorta

   (1) Celiac artery — Supplies stomach, liver, and spleen

      (a) Hepatic — Supplies liver
      (b) Splenic — Supplies spleen
      (c) Left gastric — Supplies stomach

   (2) Superior mesenteric artery — Supplies all of small intestine except the superior portion of the duodenum

   (3) Inferior mesenteric artery — Supplies all of colon and rectum except right half of transverse colon

   (4) Middle suprarenal branches — Supply adrenal (suprarenal) glands

   (5) Renal arteries — Supply kidneys, ureters, and adrenals

   (6) Testicular arteries — Supply testicles and ureter

Information Sheet

(7) Ovarian arteries — Supply ovaries, part of ureters, and uterine tubes

Note: These correspond to the internal spermatic arteries of the male.

(8) Inferior phrenic arteries — Supply diaphragm and esophagus

(9) Lumbar arteries — Supply lumbar and psoas muscles and part of abdominal wall musculature

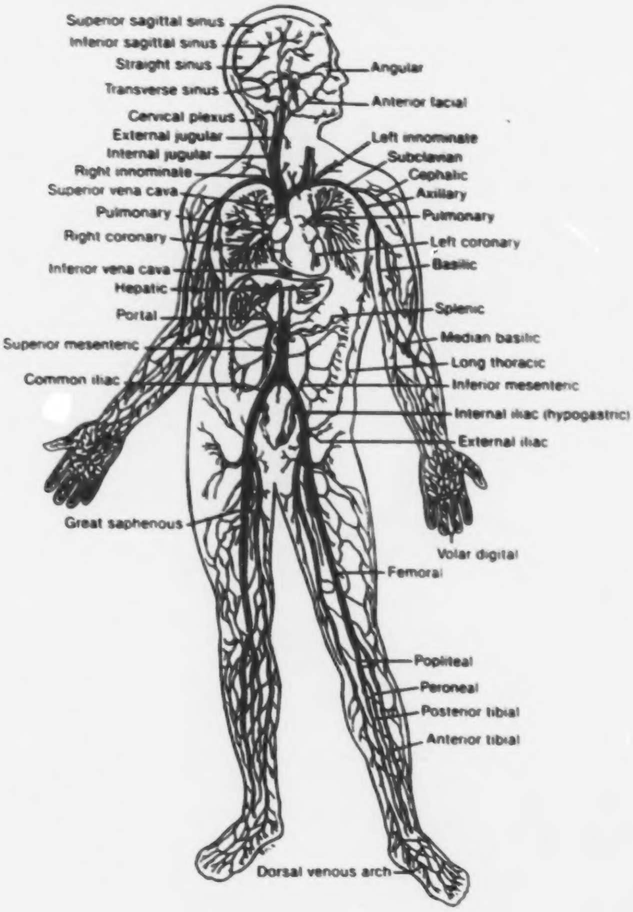
(10) Middle sacral artery — Supplies sacrum and coccyx

(11) Right and left common iliac arteries

- (a) Internal iliac (hypogastric) arteries — Supply pelvic organs
- (b) External iliac arteries — Supply lower extremities

30. Major veins of systemic circulation and areas they drain

Figure 14


Superior sagittal sinus
Inferior sagittal sinus
Straight sinus
Transverse sinus
Cervical plexus
External jugular
Internal jugular
Right innominate
Superior vena cava
Pulmonary
Right coronary
Inferior vena cava
Hepatic
Portal
Superior mesenteric
Common iliac
Great saphenous
Angular
Anterior facial
Left innominate
Subclavian
Cephalic
Axillary
Pulmonary
Left coronary
Basilic
Splenic
Median basilic
Long thoracic
Inferior mesenteric
Internal iliac (hypogastric)
External iliac
Volar digital
Femoral
Popliteal
Peroneal
Posterior tibial
Anterior tibial
Dorsal venous arch

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Information Sheet

a. Superior vena cava — Drains blood from upper half of body; one of the two large trunk veins of systemic circulation

b. Inferior vena cava — Returns blood from lower half of body; one of the two large trunk veins of systemic circulation

c. Innominate, right and left (brachiocephalic) — Draw blood from head, neck, and upper extremities; unite to form superior vena cava

d. Subclavian — Main trunk vein that drains upper extremity; joins internal jugular vein to form the innominate vein

e. Axillary — Drains axilla region

f. Internal jugular — Collects blood from brain, **superficial** parts of face, and neck; largest vein of head and neck

g. External jugular — Receives greater part of blood from exterior of cranium and **deep** parts of face

h. Long thoracic (lateral) — Drains lateral thoracic wall; tributary of axillary vein

i. Gastric; left, right, and short — Drain surface and wall of stomach

j. Hepatic, right and left — Drain the liver and then empty into the inferior vena cava

k. Splenic — Draws blood from spleen and part of stomach

l. Portal — Collects bloods from digestive tract and conveys it to the liver; formed by union of superior mesenteric and splenic veins

m. Superior mesenteric — Drains blood from small intestine

n. Inferior mesenteric — Drains blood from rectum, sigmoid, and descending parts of colon

o. Renal, right and left — Drain the kidneys

p. Common iliac, right and left — Draws blood from pelvis and legs; form inferior vena cava

q. Femoral — Drains thigh; joins great saphenous vein at inguinal ligament to become external iliac vein

r. Great saphenous — Longest vein in body draining from dorsum of foot to femoral vein just below the inguinal ligament

Information Sheet

31. **Portal circulation** (Figure 15)

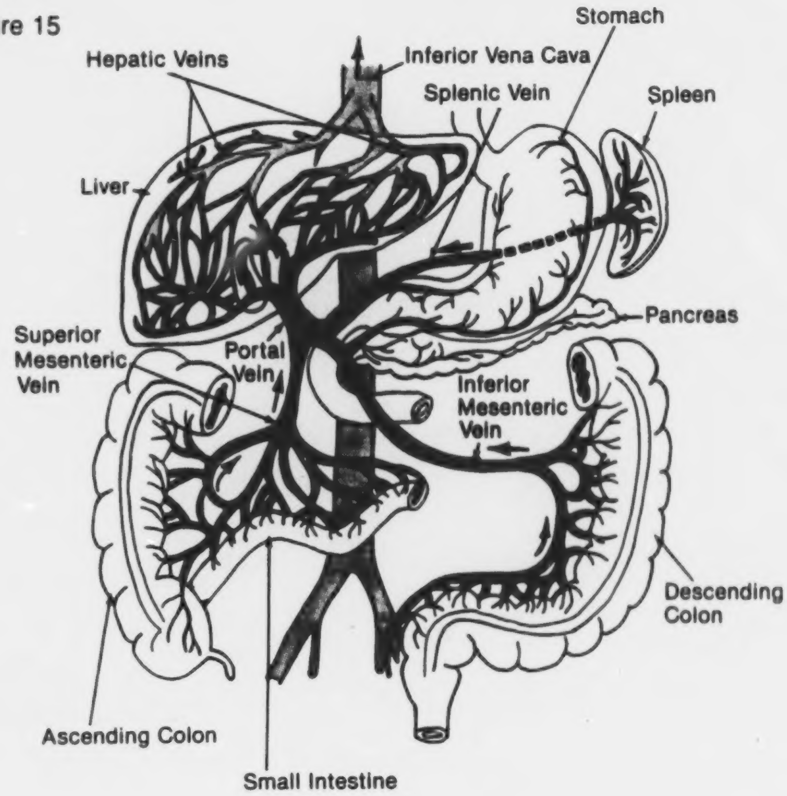
a. Veins from the stomach, intestine, spleen, and pancreas empty into one vessel, the portal vein.

b. Portal vein then carries the blood, loaded with digested food products, to the liver, where food is altered, stored, and released as needed.

Note: The liver also removes toxins from the blood.

c. Blood leaves the liver through the hepatic veins which empty into the inferior vena cava.

Figure 15


Stomach
Hepatic Veins
Inferior Vena Cava
Splenic Vein
Spleen
Liver
Pancreas
Superior Mesenteric Vein
Portal Vein
Inferior Mesenteric Vein
Descending Colon
Ascending Colon
Small Intestine

Circulatory System
Unit 9

Student Supplement 1—Complete Statements Concerning Blood and Its Constituents

Name ______________________________

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

_____ 1. The three kinds of blood cells are: Erythrocytes, Leukocytes, and

a. Monocytes
b. Thrombocytes
c. Eosinophils
d. Basophils

_____ 2. Which of the following is the oxygen-carrying red pigment of red blood cells?

a. Hematocrit
b. Oxyhemoglobin
c. Plasma
d. Hemoglobin

_____ 3. The average total blood volume in the adult is

a. 1,000 to 4,000 cc.
b. 6 to 10 liters
c. 5 pints
d. 5,000 to 5,500 cc.

_____ 4. Clotting of blood is called

a. Coagulation
b. Agglutination
c. Hemostasis
d. Hemolysis

_____ 5. Red blood cells are also known as

a. Erythrocytes
b. Leukocytes
c. Lymphocytes
d. Thrombocytes

Student Supplement 1

______ 6. Which of the following are the four blood groups?

a. A, B, AB, O
b. O, OB, B, O
c. OA, A, B, AB
d. ABO, A, B, O

______ 7. A clot which remains attached to its point of origin and obstructs blood flow is called

a. Embolus
b. Thrombus
c. Infarct
d. Aneurysm

______ 8. Hemolysis can be defined as

a. Overproduction of red blood cells
b. Manufacture of red blood cells
c. Breakdown of white blood cells
d. Destruction of red blood cells

______ 9. The condition of being a known bleeder is known as

a. Dyscrasia
b. Leukopenia
c. Hemopoietic
d. Hemophilia

______10. An abnormal loss of blood, either externally or internally, is called

a. Shock
b. Hemolysis
c. Hemorrhage
d. Embolus

______11. The process of helping protect the body from infection by "eating" up bacteria or by breaking up and liberating substances which destroy bacteria is known as

a. Mononucleosis
b. Leukocytosis
c. Phagocytosis
d. Thrombocytosis

Student Supplement 1

______12. The injection of the blood of one person into the blood vessels of another is called

a. Transfusion
b. Coagulation
c. Transplant
d. Hemolysis

______13. Erythrocytes are formed in the

a. Lymph nodes
b. Red bone marrow
c. Yellow bone marrow
d. Lymphoid tissue

______14. The normal range for platelet count per cubic millimeter of blood is

a. 200,000 to 500,000
b. 9,000 to 15,000
c. 1,000,000 to 3,000,000
d. 150,000 to 200,000

______15. The study of blood is called

a. Pathology
b. Homeostasis
c. Hematology
d. Physiology

______16. Fewer than the normal number of platelets can cause

a. Infection
b. Hemorrhage
c. Jaundice
d. Clotting

______17. Clotting in blood vessels is prevented by the smooth lining of the blood vessels and

a. Calcium
b. Fibrin
c. Heparin
d. Prothrombin

Student Supplement 1

______18. A substance that prevents blood from clotting is called a(n)

a. Anticoagulant
b. Coagulant
c. Serum
d. Antibody

______19. Hemostasis can best be defined as

a. Preventing or delaying the formation of blood clots
b. Stopping the bleeding
c. The state of chemical balance between the cell and its environment
d. Conduction of electricity by means of its ions

______20. In the normal adult the average number of leukocytes per cubic millimeter of circulating blood is

a. 1000 to 4000
b. 3000 to 8000
c. 5000 to 10,000
d. 10,000 to 20,000

______21. The liquid part of blood (without cells) is known as

a. Keratin
b. Fibrinogen
c. Hemoglobin
d. Plasma

______22. The substance produced by the liver necessary for the clotting of blood is

a. Vitamin K
b. Platelets
c. Prothrombin
d. Fibrin

______23. The universal donor is blood type

a. AB
b. A
c. B
d. O

Student Supplement 1

______24. ____________ help to form blood clots following injury to blood vessels.

a. Leukocytes
b. Capillaries
c. Platelets
d. Arterioles

______25. Principal components of blood plasma include all of the following **EXCEPT**

a. Water and blood proteins
b. Minerals, salts, and waste products
c. Bile
d. Hormones and vitamins

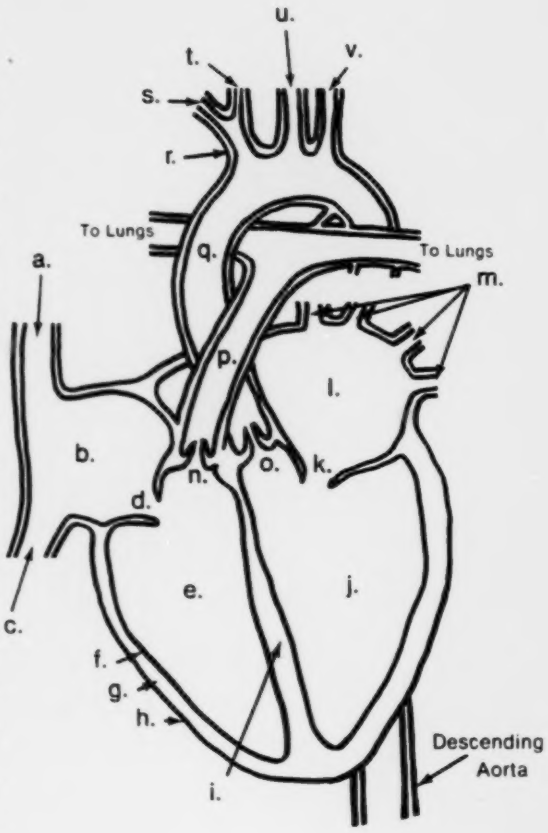
Circulatory System
Unit 9

Student Supplement 2—Identify the Parts of the Heart

Name ____

Directions: Identify the parts of the heart in the following illustration, and place your answers in the blanks provided.

a. ____________________________
b. ____________________________
c. ____________________________
d. ____________________________
e. ____________________________
f. ____________________________
g. ____________________________
h. ____________________________
i. ____________________________
j. ____________________________
k. ____________________________
l. ____________________________
m. ____________________________
n. ____________________________
o. ____________________________
p. ____________________________
q. ____________________________
r. ____________________________
s. ____________________________
t. ____________________________
u. ____________________________
v. ____________________________


u.
t.
v.
s.
r.
To Lungs
q.
To Lungs
a.
m.
p.
l.
b.
n.
o.
k.
d.
e.
j.
c.
f.
g.
h.
i.
Descending Aorta

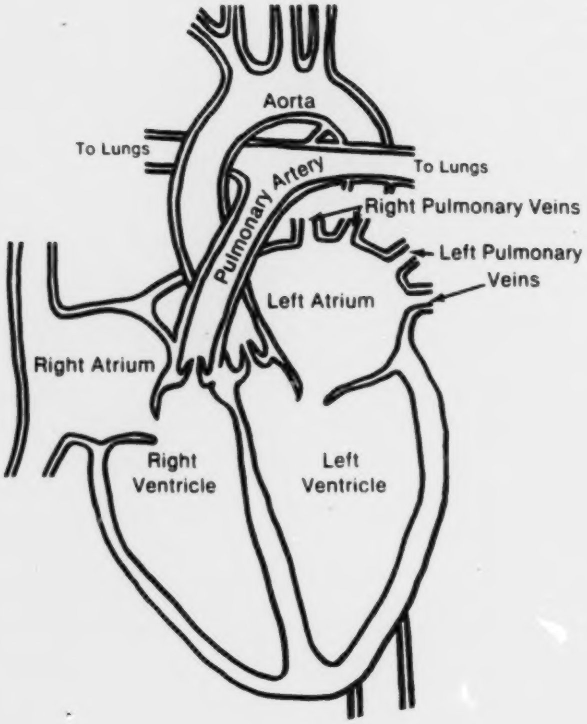
Circulatory System
Unit 9

Student Supplement 3—Trace the Circulation of Blood Through the Heart

Name ____

Directions: Trace the circulation of blood through the heart in the illustration below. Begin drawing your arrows at the inferior vena cava. Use straight arrows to indicate oxygenated blood and wavy arrows to indicate deoxygenated blood.

Oxygenated blood ➡
Deoxygenated blood ⇝

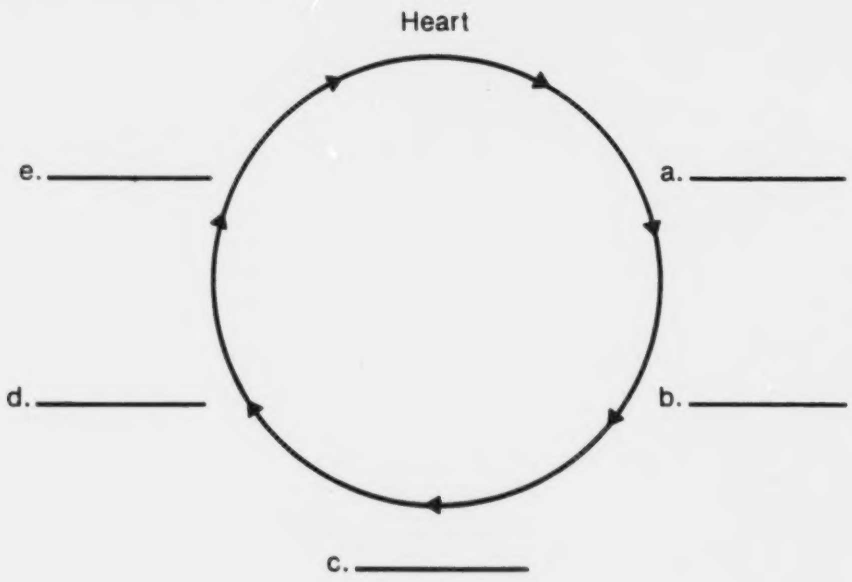

Aorta
To Lungs
To Lungs
Pulmonary Artery
Right Pulmonary Veins
Left Pulmonary Veins
Left Atrium
Right Atrium
Right Ventricle
Left Ventricle

Circulatory System
Unit 9

Student Supplement 4—Complete an Illustration of the Circulation of Blood Through Vessels

Name ______________________________

Directions: Complete the following illustration showing the circulation of blood through the various types of vessels.



Circulatory System
Unit 9

Student Supplement 5—Complete Statements Concerning the Circulatory System

Name ______________________________

Directions: Complete the following statements or questions by placing the correct letters in the blanks provided.

_____ 1. All of the following are functions of the circulatory system **EXCEPT**

a. Combating infection
b. Detoxification of drugs
c. Maintenance of homeostasis
d. Transportation of O_2 and CO_2 to and from body cells

_____ 2. The blood in the chambers of the right side of the heart would be

a. Higher in oxygen content than that in the left side
b. About equal in oxygen content to that in the left side
c. Equal in carbon dioxide content to that in the left side
d. Lower in oxygen content than that in the left side

_____ 3. An excessive amount of fluid in the pericardial sac is called

a. Pericarditis
b. Pericardial effusion
c. Empyema
d. Pleurisy

_____ 4. Which of the following is the heart's blood supply?

a. Coronary arteries
b. Renal arteries
c. Aorta
d. Celiac artery

_____ 5. Which group of blood vessels concerns itself with eliminating carbon dioxide from the blood and replenishing its supply of oxygen?

a. Capillaries
b. Systemic veins
c. Systemic arteries
d. Pulmonary vessels

Student Supplement 5

______ 6. The sac covering the heart is called the

a. Myocardium
b. Endocardium
c. Pericardium
d. Visceral pericardium

______ 7. Arteries are vessels defined as carrying

a. Blood away from the heart
b. Blood toward the heart
c. Blood through the lungs
d. Blood through the heart chambers

______ 8. The color of arteries are

a. Purple
b. Dark red
c. Blue
d. Bright red

______ 9. Veins are vessels defined as carrying

a. Blood through the heart chambers
b. Blood to the lungs
c. Blood toward the heart
d. Blood away from the heart

______10. The abdominal aorta bifurcates into the

a. Pulmonary arteries
b. Femoral arteries
c. Right and left common iliac arteries
d. Internal and external iliac arteries

______11. The great saphenous vein is located

a. In the brain
b. In the arm
c. In the abdomen
d. In the leg

______12. The branch of the external iliac artery that is located in the thigh is called the

a. Tibial artery
b. Femoral artery
c. Popliteal artery
d Celiac artery

Student Supplement 5

______13. The walls of veins are

a. The same thickness as those of the arteries
b. Thicker than the artery walls
c. Made of cardiac muscle cells
d. Thinner than the artery walls

______14. Which of the following connect arterioles and venules?

a. Veins
b. Platelets
c. Systemic arteries and veins
d. Capillaries

______15. Which artery supplies the head and neck?

a. Subclavian
b. Carotid
c. Brachiocephalic
d. Aortic arch

______16. Pulmonary circulation starts its circuit by leaving the

a. Right ventricle through the pulmonary artery
b. Left ventricle through the pulmonary artery
c. Left atrium through the aorta
d. Right atrium through the aorta

______17. Which of the following is the trunk artery of systemic circulation?

a. Superior vena cava
b. Aorta
c. Pulmonary artery
d. Inferior vena cava

______18. The innominate artery divides into the

a. Left common carotid artery and left subclavian artery
b. Right subclavian and vertebral arteries
c. Right common carotid artery and right subclavian
d. Celiac trunk

______19. The large trunk vein of the upper body is the

a. Inferior vena cava
b. Pulmonary veins
c. Aorta
d. Superior vena cava

Student Supplement 5

______20. The veins of the head and neck are drained by the

a. Basilic vein
b. Cephalic veins
c. Azygos vein
d. Jugular veins

______21. The walls of arteries are

a. Very thin, allowing for expansion with each heartbeat
b. Thick, elastic walls which contract and expand
c. Lined with a thick membrane which prevents their expansion
d. Lined at intervals with valves

______22. All of the following vessels branch off the aortic arch **except** the

a. Left subclavian artery
b. Innominate artery
c. Left common carotid artery
d. Coronary arteries

______23. In systemic circulation, the blood returns from the body and enters the

a. Right ventricle by way of the vena cava
b. Right atrium by way of the vena cava
c. Left atrium by way of the pulmonary veins
d. Left ventricle by way of the aorta

______24. The longest vein in the body is the

a. Femoral
b. Great saphenous
c. Iliac
d. Vena cava

______25. The large trunk vein of the lower body is the

a. Aorta
b. Pulmonary artery
c. Superior vena cava
d. Inferior vena cava

______26. The chief job of the veins is to

a. Filter out foreign materials in the blood
b. Return unoxygenated blood to the heart
c. Carry oxygenated blood to the cells
d. Permit the exchange of oxygen and carbon dioxide

Student Supplement 5

_____27. The superior and inferior mesenteric arteries supply the

a. Stomach
b. Intestines
b. Spleen
c. Kidney

_____28. One suffering from inflammation of a vein would have

a. Arteriosclerosis
b. Lymphangitis
c. Cellulitis
d. Phlebitis

_____29. From which source does the axillary artery receive its blood supply?

a. Subclavian artery
b. Innominate artery
c. Brachial artery
d. Brachiocephalic artery

_____30. The right and left innominate veins unite and form

a. Superior vena cava
b. Celiac vein
c. Inferior vena cava
d. Aorta

_____31. The kidneys are supplied with oxygenated blood from the

a. Suprarenal arteries
b. Phrenic arteries
c. Carotid arteries
d. Renal arteries

_____32. The heart receives its own blood supply from the

a. Carotid arteries
b. Cardiac arteries
c. Coronary arteries
d. Iliac arteries

_____33. The hepatic, left gastric, and splenic arteries are branches of the

a. Innominate artery
b. Aortic artery
c. Celiac artery
d. Common iliac artery

Student Supplement 5

______34. The two arteries branching off from the ascending aorta are the

a. Pulmonary arteries
b. Brachial arteries
c. Bronchial arteries
d. Coronary arteries

______35. A small artery is known as a(n)

a. Arteriole
b. Capillary
c. Arteriolyte
d. Ductus arteriosus

Lymphatic System
Unit 10

Objective Sheet

Unit Objective

After completing this unit, the student should be able to identify the structures of the lymphatic system and complete statements concerning their characteristics. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the lymphatic system with their correct definitions.
2. List the functions of the lymphatic system.
3. Identify the structures of the lymphatic system.
4. Select true statements concerning the characteristics of lymph.
5. Complete statements concerning the movement of lymph.
6. Select true statements concerning the characteristics of lymph capillaries.
7. Complete statements concerning the characteristics of lymph vessels.
8. Distinguish between the major lymph ducts.
9. Complete statements concerning the characteristics of lymph nodes and nodules.
10. Identify the major lymph nodes.
11. Identify the types of tonsils.
12. Complete statements concerning the characteristics of the thymus.
13. Select true statements concerning the characteristics and functions of the spleen.

Lymphatic System
Unit 10

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Lymphatic Structures (Objective 3)
   TM 2—Major Lymph Ducts (Objective 8)
   TM 3—Major Lymph Nodes (Objective 10)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form, which follows the written test section.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplement. This could be used as a homework assignment, daily practice exercise, or quiz. Explain to students how you plan to evaluate the supplement, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Compile written test scores on the Unit Evaluation Form. Include any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Discuss the anatomy of the lymphatic system using the transparencies included with this unit and other illustrations, wall charts, or models available.

2. Show films available concerning the lymphatic system.

3. Briefly discuss the role of the lymphatic system in relation to body defenses and immunity, such as metastasis of cancer cells, tonsillitis, vaccines, etc.

4. Invite a guest speaker to discuss with your class the various diseases and disorders related to the lymphatic system, such as lymphoma, Hodgkin's disease, AIDS, HIV+, etc. Skill area: **Communication**

5. Have students briefly discuss personal experiences with family members or friends who have diseases/disorders related to the lymphatic system. Encourage them to not mention names. Skill area: **Communication**

6. Conduct a modified spelling bee or "genius bowl." Divide class into two teams. Use material from the information sheet, Student Supplement 1, and other information provided by instructor as the questions. The moderator (instructor) asks team one (or a selected member) a question. If answered correctly, the team scores one point. If answered incorrectly, a person on team two has the opportunity to answer it and score the point. If the second team is unable to answer, the moderator may give the correct answer or hints. The team with the most points at the end of the allotted time wins. Small rewards for the winning team members are big motivators! Skill areas: **Communication, Personal Management**, and **Group Effectiveness**

Suggested Activities

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis, MO: C. V. Mosby Company, 1987.
2. Burton, Gwendolyn R. W. *Microbiology for the Health Sciences*, 4th ed. Philadelphia: J. B. Lippincott Company, 1992.
3. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.
4. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.
5. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.
6. Memmler, Ruth L., Barbara Janson Cohen, and Dena Lin Wood. *Structure and Function of the Human Body*, 5th ed. Philadelphia: J.B. Lippincott Company, 1992.
7. Scanlon, Valerie C. and Tina Sanders. *Essentials of Anatomy and Physiology*. Philadelphia: F. A. Davis, 1991.

Suggested Supplemental Resources

1. Videotape—*Internal Defenses*, part of *The Living Body* Series available from:

   Films for the Humanities and Sciences
   P.O. Box 2053
   Princeton, NJ 08543-2053
   800-257-5126 or 609-452-1128

2. Anatomy charts and models on the lymphatic system are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
   P.O. Box 21207
   Waco, TX 76702-1207
   800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
   3823 Leavenworth Street
   Omaha, NB 68105
   800-228-7117

Lymphatic System
Unit 10

Answers to Student Supplement

Student Supplement 1

1. d
2. a
3. c
4. c
5. a
6. d
7. b
8. b
9. b
10. b
11. c
12. c
13. c
14. a
15. c
16. c
17. b
18. a
19. d
20. d
21. c
22. a
23. b
24. c
25. a

Lymphatic System
Unit 10

Answers to Written Test

1. a. 3 e. 6
b. 5 f. 7
c. 10 g. 2
d. 4

2. a. Removes excess tissue fluid and other substances from the body tissue
b. Processes blood cells

3. a. Lymph nodes
b. Tonsils
c. Thymus
d. Spleen
e. Lymph vessels

4. a. F
b. T
c. F

5. a. Pump
b. Skeletal muscle contractions
c. One-way valves
d. Lymph capillary, major lymph duct, subclavian vein (must be in this order)

6. a. T
b. T
c. F

7. a. Thin
b. 3
c. 1

8. a. O
b. X
c. X
d. O
e. O

9. a. 2
b. 2
c. 3
d. 1

Answers to Written Test

10. a. Cervical
    b. Axillary
    c. Inguinal

11. a. Nasopharyngeal (adenoids)
    b. Palatine
    c. Lingual

12. a. Upper
    b. Infancy
    c. Decrease
    d. Lymphocytes
    e. Thymosin

13. a. F
    b. T
    c. F
    d. F
    e. F
    f. F
    g. T
    h. T

Lymphatic System
Unit 10

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______a. A dilation at the beginning of the thoracic duct which is a temporary storage pouch for chyle

______b. Specialized lymph capillaries in the small intestines that transport chyle through the lymphatic system to the circulatory system

______c. Thymic lymphoid cells developed in the thymus important in the body's cellular immune response

______d. Relating to the space between tissues usually occupied by fluid

______e. Tissue fluid which has entered a lymphatic capillary

______f. The process by which bacteria or body cells, especially cancer cells, are spread from one part of the body to another through the lymphatic system or circulatory system

______g. Milky fluid composed mainly of fat globules and lymph from the intestinal lacteals

1. Adenoids
2. Chyle
3. Cisterna chyli
4. Interstitial
5. Lacteals
6. Lymph
7. Metastasis
8. Node
9. Nodule
10. T cells

2. List the two functions of the lymphatic system.

a. ____

b. ____

Written Test

3. Identify the following structures of the lymphatic system, and place your answers in the blanks.

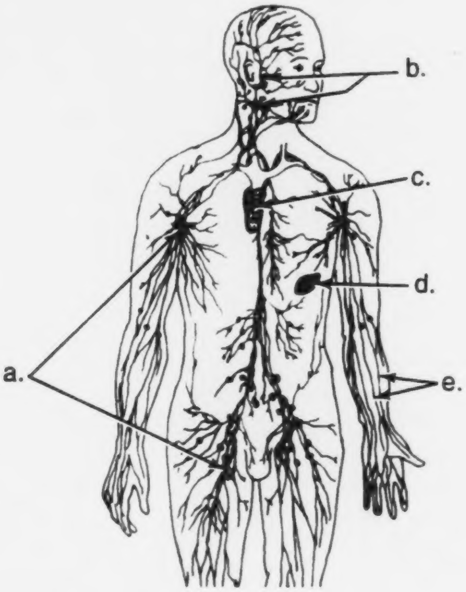
a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________



4. Select true statements concerning the characteristics of lymph by placing a "T" or "F" next to the true or false statements.

______a. Is a pinkish (blood-tinged) fluid

______b. Differs in composition from blood in that red blood cells are absent

______c. Resembles plasma in composition, but contains more protein

5. Complete statements concerning the movement of lymph by filling in the blanks with the correct word(s).

a. The lymphatic system has no ____________ to force movement.

b. Movement of lymph is caused by breathing and by ____________________.

c. Movement is slow, and the system contains ____________ which prevent the lymph from flowing backward.

d. Lymph flows as follows:

Tissue spaces → ____________ → Lymph vessel → Lymph node → Lymph vessel → ____________ → ____________ → Circulatory system

Written Test

6. Select true statements concerning the characteristics of lymph capillaries by placing a "T" or "F" next to the true or false statements.

   ______a. Lymph capillaries are the smallest lymph vessels which carry lymph from tissue spaces to larger lymph vessels.

   ______b. Unlike blood capillaries, they do not bridge two larger vessels. One end of a lymph capillary lies in a pool of tissue fluid; the other end connects with a larger lymph vessel.

   ______c. Like blood capillaries, they consist of many layers of muscle cells.

7. Complete statements concerning the characteristics of lymph vessels by circling the correct words.

   a. Are (thick, thin) walled, very permeable vessels.

   b. Have (2, 3) layers.

   c. Have valves to keep lymph moving in (1, 2) direction(s).

8. Distinguish between the major lymph ducts by placing an "X" next to the characteristics of the right lymphatic duct and an "O" next to those of the thoracic duct.

   ______a. Empties into the left subclavian vein

   ______b. Empties into the right subclavian vein

   ______c. Receives lymph from right side of head, neck, thorax, and upper extremity

   ______d. Begins in posterior part of abdominal cavity, extends upward through the diaphragm, along the posterior wall of the thorax, and into the base of the neck on the left side

   ______e. Receives lymph from all parts of the body except those above the diaphragm on the right side

9. Complete statements concerning the characteristics of lymph nodes and nodules by selecting the best answers from the multiple choices.

   ______a. Lymph nodes range in size up to ______ inch(es).

   (1) ½
   (2) 1
   (3) 1½
   (4) 2

______b. Lymph nodes produce

(1) Leukocytes
(2) Lymphocytes
(3) Erythrocytes
(4) Basophils

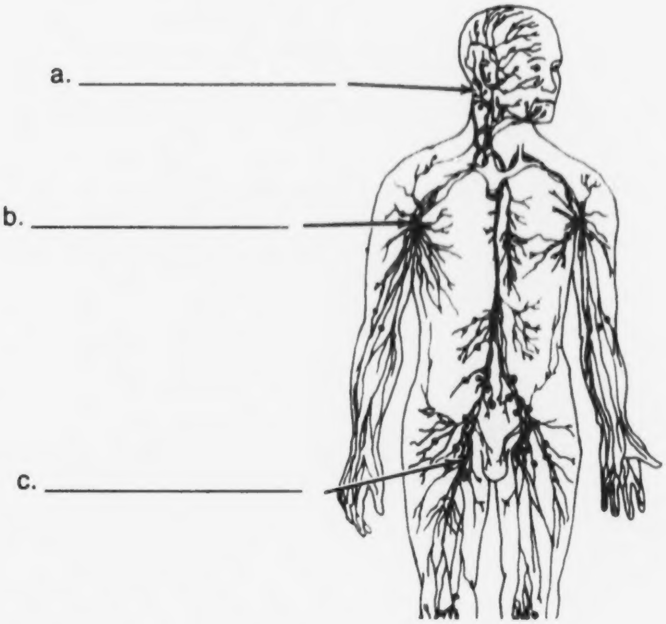
______c. Lymph nodes serve as

(1) Carbohydrate synthesizers
(2) Fuel producers
(3) Filters
(4) Protein synthesizers

______d. Specific lymph nodules located in the small intestines are

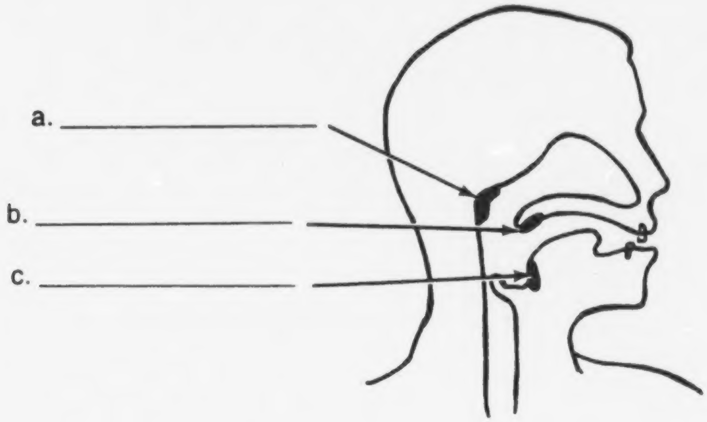
(1) Peyer's Patch
(2) Iliac nodules
(3) Tonsils
(4) Lymphocolon nodules

10. Identify the major lymph nodes, and place your answers in the blanks.



Written Test

11. Identify the types of tonsils, and place your answers in the blanks.



12. Complete statements concerning the characteristics of the thymus by circling the correct words.

    a. Is a two-lobed organ located in the (lower, upper) part of the chest cavity

    b. Is largest and most active during (infancy, adulthood)

    c. (Increases, Decreases) in size and activity after puberty

    d. Produces (erythrocytes, lymphocytes) which function in the body's defenses against infection

    e. Secretes the hormone (thymosin, thyroxine) which is necessary for the maturity of the T cells and for the growth of lymphoid tissue throughout the body

13. Select true statements concerning the characteristics and functions of the spleen by placing a "T" or "F" next to the true or false statements.

    ______a. The spleen is the smallest mass of lymphoid tissue in the body.

    ______b. It is located in the upper left quadrant of the abdominal cavity behind the stomach.

    ______c. It is 1 inch long and ½ inch wide.

    ______d. It is soft, spongy, and white in color.

Written Test

______e. In the embryo, it produces only lymphocytes.

______f. In the adult, it forms only erythrocytes (red blood cells).

______g. It filters cancer cells and other particulate matter.

______h. It stores blood (about 350 cc) which can be returned to the bloodstream in case of hemorrhage or other emergency.

***Permission to duplicate this test is granted.**

Lymphatic System
Unit 10

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest ______ Posttest ______ Other ______

Other ____

____

Teacher Signature ______________________________ Date __________

Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.

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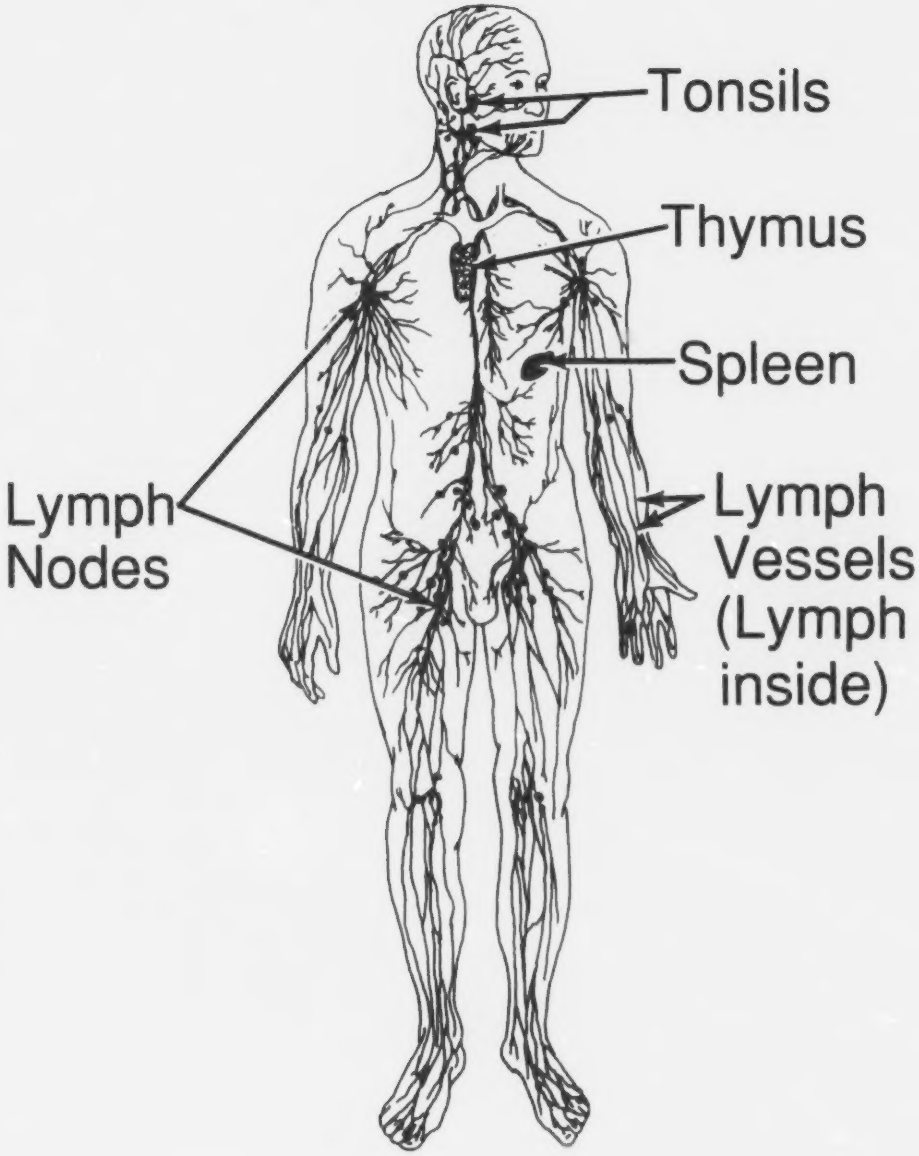
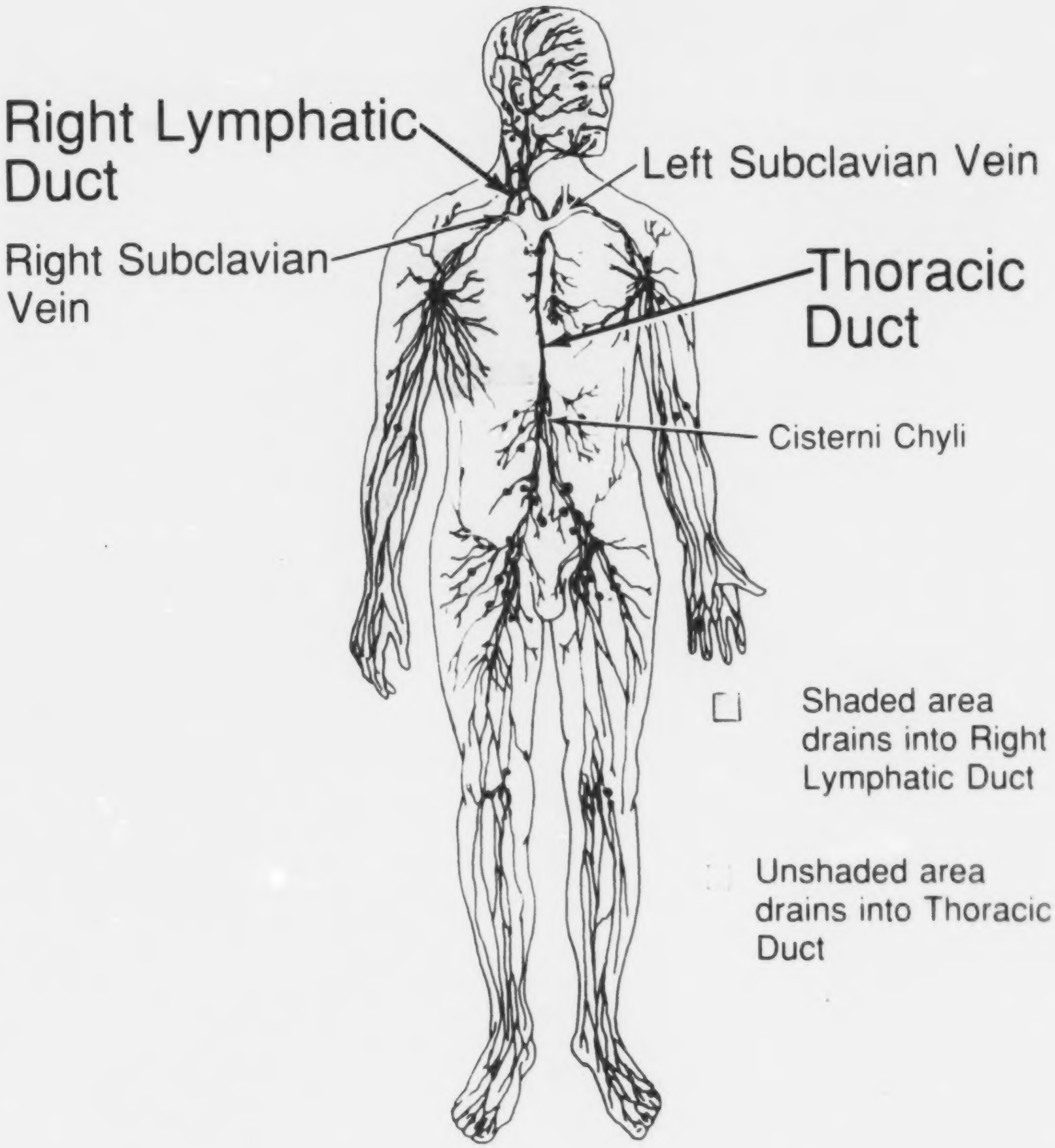
Lymphatic Structures

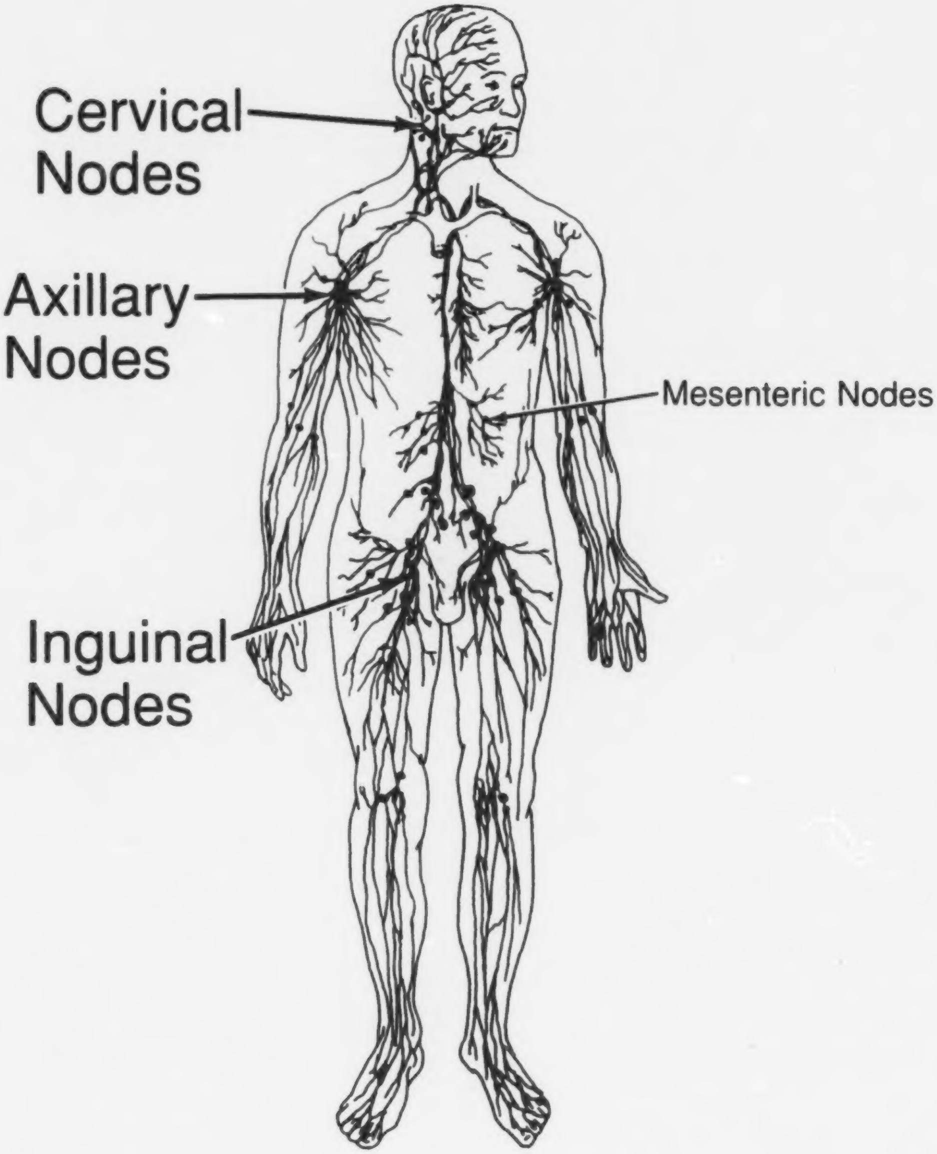

Tonsils
Thymus
Spleen
Lymph Nodes
Lymph Vessels (Lymph inside)

534

Major Lymph Ducts


Right Lymphatic Duct
Left Subclavian Vein
Right Subclavian Vein
Thoracic Duct
Cisterni Chyli
☐ Shaded area drains into Right Lymphatic Duct
☐ Unshaded area drains into Thoracic Duct

Major Lymph Nodes


Cervical Nodes
Axillary Nodes
Mesenteric Nodes
Inguinal Nodes

Lymphatic System
Unit 10

Information Sheet

1. **Terms and definitions**

   a. **Adenoids** — Masses of lymphoid tissue in the nasopharyngeal region

   b. **Chyle** — Milky fluid composed mainly of fat globules and lymph from the intestinal lacteals

   c. **Cisterna chyli** — A dilation at the beginning of the thoracic duct which is a temporary storage pouch for chyle

   d. **Interstitial** — Relating to the space between tissues usually occupied by fluid

   e. **Lacteals** — Specialized lymph capillaries in the small intestines that transport chyle through the lymphatic system to the circulatory system (by way of the thoracic duct)

   f. **Lymph** — Tissue fluid which has entered a lymphatic capillary

   g. **Metastasis** — The process by which bacteria or body cells, especially cancer cells, are spread from one part of the body to another through the lymphatic system or circulatory system

   h. **Node** — A small, rounded mass

   i. **Nodule** — A small node

   j. **T cells** — Thymic lymphoid cells developed in the thymus important in the body's cellular immune response

2. **Functions of the lymphatic system**

   a. Removes excess tissue fluid and other substances from the body tissue

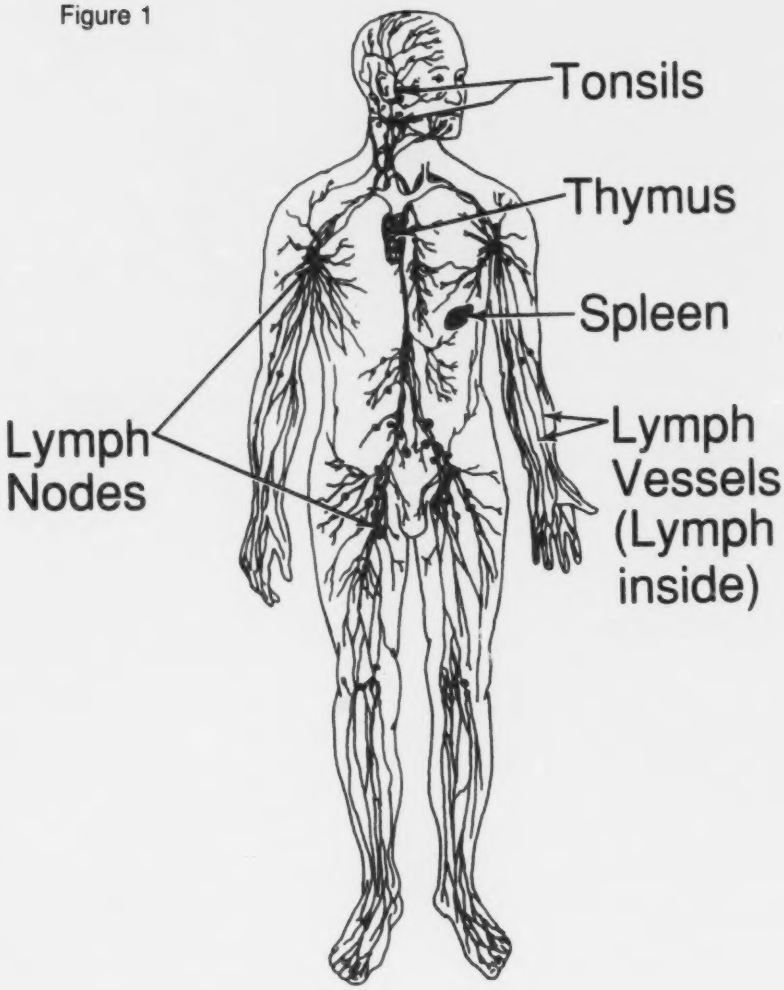
      Examples: Dead blood cells, carbon, cancer cells, pathogens, excess protein

   b. Processes blood cells

Information Sheet

3. **Structures in the lymphatic system**
   a. Lymph
   b. Lymph capillaries, vessels, and ducts
   c. Lymph nodes
   d. Tonsils
   e. Thymus
   f. Spleen

Figure 1


Tonsils
Thymus
Spleen
Lymph Nodes
Lymph Vessels (Lymph inside)

Information Sheet

4. Characteristics of lymph

a. Is a clear, transparent, colorless fluid (except in lymph vessels draining the intestines where it may appear milky from the presence of absorbed fats)

b. Differs in composition from blood in that red blood cells are absent

c. Resembles plasma in composition, but contains less protein

5. Movement of lymph

a. The lymphatic system has no pump to force movement.

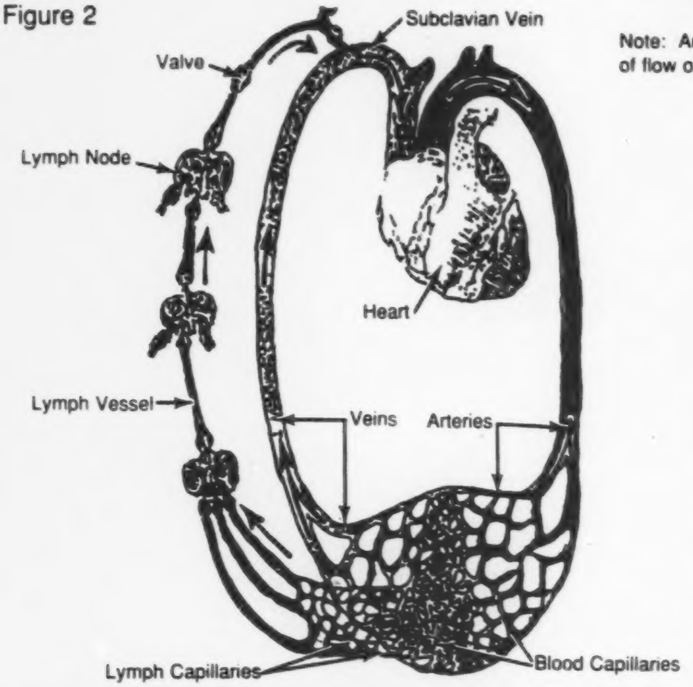
b. Movement of lymph is caused by breathing and by skeletal muscle contractions.

c. Movement is slow, and the system contains one-way valves which prevent the lymph from flowing backward.

d. Lymph flows as follows:

Tissue spaces → Lymph capillary → Lymph vessel → Lymph node → Lymph vessel → Major lymph duct → Subclavian vein → Circulatory system

Figure 2


Subclavian Vein
Valve
Lymph Node
Heart
Lymph Vessel
Veins
Arteries
Lymph Capillaries
Blood Capillaries

Note: Arrows indicate direction of flow of the blood and lymph.

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Information Sheet

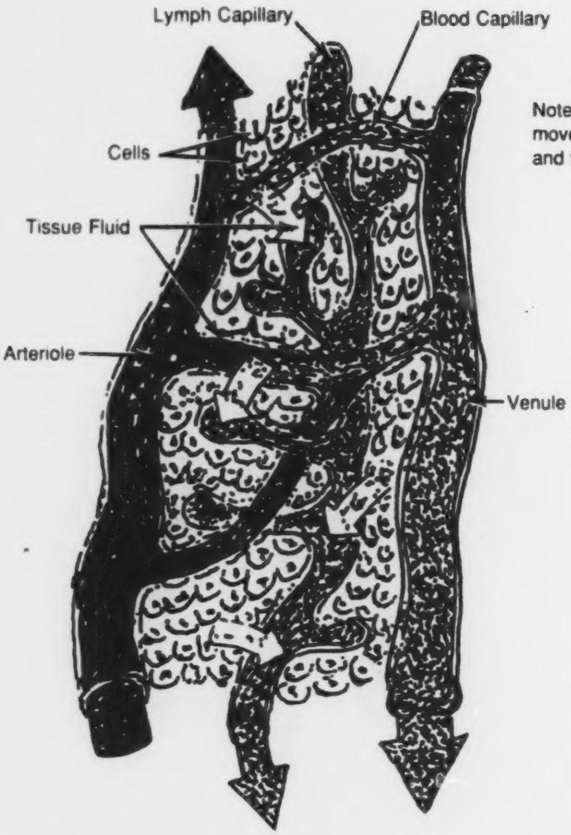
6. Characteristics of lymph capillaries

a. Are the smallest lymph vessels which carry lymph from tissue spaces to larger lymph vessels

b. Unlike blood capillaries, they do not bridge two larger vessels. One end of a lymph capillary lies in a pool of tissue fluid; the other end connects with a larger lymph vessel.

c. Like blood capillaries, they consist of one layer of flattened epithelial cells.

Figure 3


Lymph Capillary
Blood Capillary
Cells
Tissue Fluid
Arteriole
Venule

Note: Arrows indicate the movement of plasma, lymph, and tissue fluid.

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Information Sheet

7. Characteristics of lymph vessels

a. Are thin walled, very permeable vessels which convey lymph from lymph capillaries to lymph nodes and from lymph nodes to lymph ducts.

b. Resemble veins in that they have three layers and valves to prevent backflow and keep lymph moving in only one direction.

Note: Infection of lymph vessels is called lymphangitis. Infection of the lymph nodes is called lymphadenitis.

8. Major lymph ducts

a. Right lymphatic duct

(1) Located above the diaphragm and on the right side of the body

(2) Receives lymph from right side of head, neck, thorax, and upper extremity

(3) Empties into right subclavian vein

b. Thoracic duct

(1) Begins in posterior part of abdominal cavity, extends upward through the diaphragm, along the posterior wall of the thorax, and into the base of the neck on the left side.

Note: The first part of this duct is the cisterna chyli.

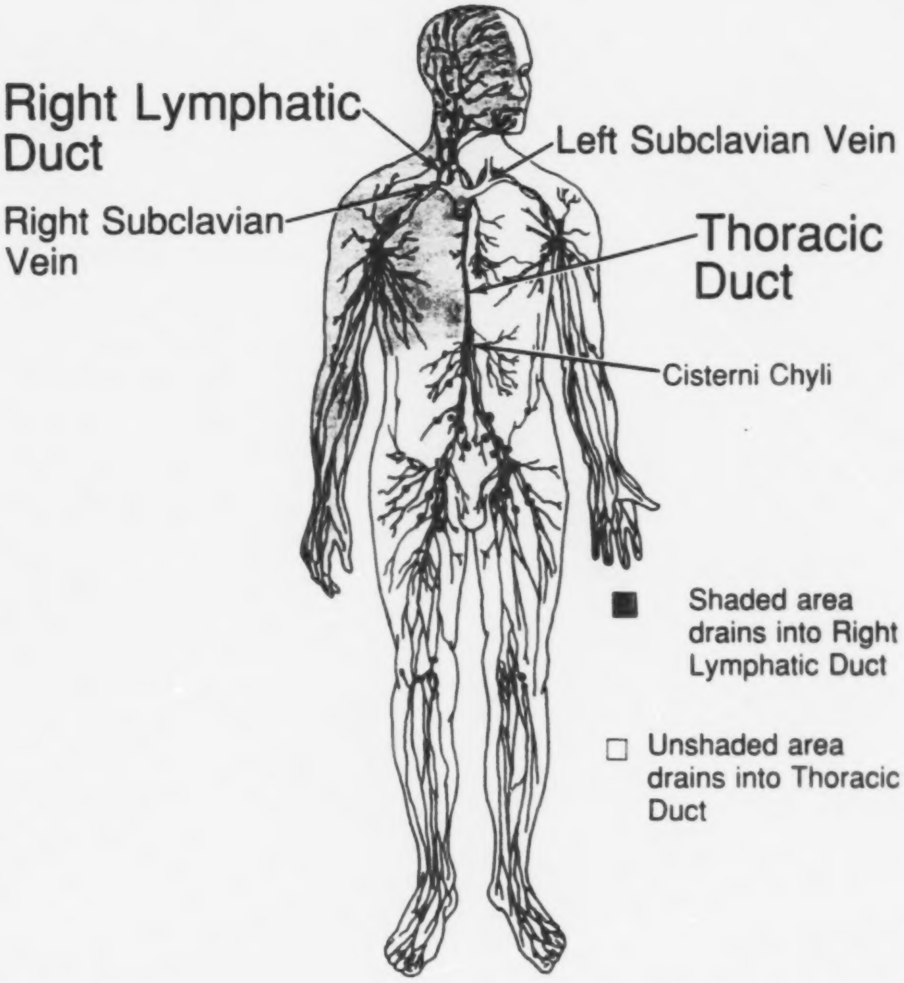
(2) Receives lymph from all parts of the body except those above the diaphragm on the right side (those drained by the right lymphatic duct)

(3) Empties into the left subclavian vein

Note: These ducts have valves which prevent blood from entering them.

Information Sheet

Figure 4


Right Lymphatic Duct
Left Subclavian Vein
Right Subclavian Vein
Thoracic Duct
Cisterni Chyli

■ Shaded area drains into Right Lymphatic Duct

☐ Unshaded area drains into Thoracic Duct

Information Sheet

9. Characteristics of lymph nodes and nodules

a. Are deep or superficial masses of lymphoid tissue found along the lymphatic system. Lymph nodules are located throughout the body beneath all mucous membranes.

b. Range in size from the size of a pin head for nodules to one inch in length for nodes.

c. Produce lymphocytes and monocytes

d. Serve as filters (comparable to oil filters on a car) to keep substances such as bacteria from entering the bloodstream.

Note: Lymph nodes may stop cancer cells, or may be the seat of cancer. When cancer is surgically removed from an area, the lymph vessels and nodes may also be removed at the same time to decrease the chance of metastasis.

e. Specific nodes are identified by their location in the body. Specific nodules include Peyer's Patch in the small intestines and tonsils in the pharynx.

10. Major lymph nodes

Note: Although the body contains many lymph nodes, three groups deserve special attention because of their strategic locations. They are located at the junctions of the head and extremities with the trunk of the body. Pathogens are more likely to enter through an opening on the arm, leg, or head rather than the trunk. These groups of lymph nodes will destroy the pathogen before it reaches the vital organs of the trunk.

a. **Cervical** — Drain part of head and neck

Note: Strep throat may cause "swollen glands." These are enlarged cervical lymph nodes resulting from the attempts of the cervical node to destroy the pathogen in the lymph from the pharynx.

b. **Axillary** — Located in the armpits

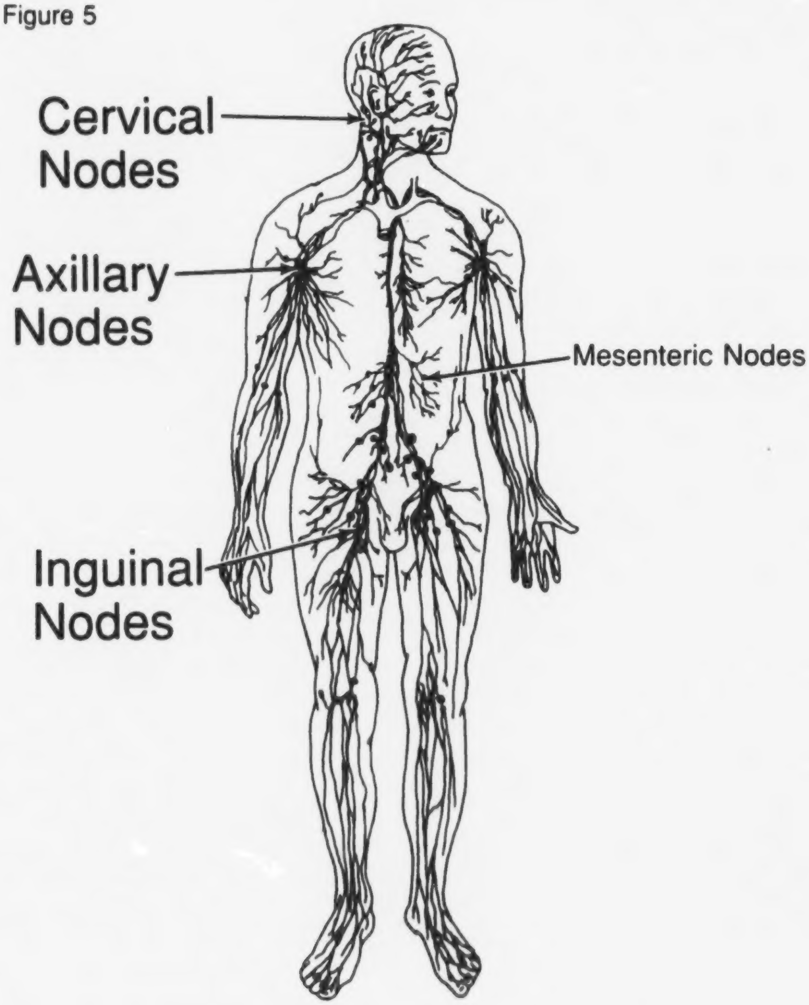
Note: Cancer cells from the breast often metastasize to the axillary nodes.

c. **Inguinal** — Located in the groin region; drain the lower extremities and external genital organs

Note: The mesenteric nodes are also significant from a surgical standpoint because of their location in the abdominal peritoneum and their involvement with infection control following abdominal surgery.

Information Sheet

Figure 5


Cervical Nodes
Axillary Nodes
Mesenteric Nodes
Inguinal Nodes

Information Sheet

11. Types of tonsils

Note: The tonsils form a ring of lymphatic tissue around the pharynx. This is the pathway for food and air which often contain pathogens.

a. Nasopharyngeal tonsils

  (1) Commonly called the adenoids

  (2) Located behind the nose on the roof of the posterior wall of the pharynx

b. Palatine tonsils

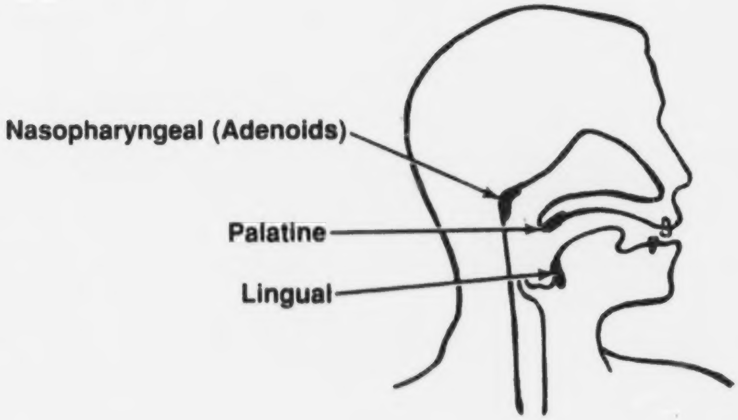
  (1) Located in the back of the mouth on the lateral walls of the pharynx

  (2) Are usually referred to as "the tonsils"

c. Lingual tonsils — Located at the base of the tongue

Note: A tonsillectomy is the surgical removal of the palatine tonsils. An adenoidectomy is the surgical removal of the nasopharyngeal tonsils.

Figure 6



Note: All lymphoid tissue masses tend to be larger in childhood. Therefore, age is a consideration in determining whether an enlarged mass is normal or abnormal. Since tonsils appear to be linked to immunity in childhood, they are not removed unless necessary.

Information Sheet

12. Characteristics of the thymus

a. Is a two-lobed organ located in the upper part of the chest cavity along the trachea inferior to the thyroid and posterior to the sternum

b. Is largest and most active during prenatal life and infancy

Note: Because of its location, an enlarged thymus can impair breathing and circulation in a newborn infant.

c. Decreases in size and activity after puberty and is replaced by connective tissue

d. Produces lymphocytes (T cells) which function in the body's defenses against infection, especially in prenatal life and infancy

e. Secretes the hormone thymosin, which is necessary for the maturity of the T cells and for the growth of lymphoid tissue throughout the body

Note: The thymus can be removed without causing serious damage, but its removal does cause a decrease in the production of T cells, as well as a decrease in the size of the spleen and lymph nodes throughout the body. The end result may be an increased susceptibility to acute infection in the future.

13. Characteristics and functions of the spleen

Note: Because the spleen contains lymphoid tissue, it is included in the lymphatic system. However, because of its functions, it can also be considered a part of the circulatory system.

a. Characteristics

(1) Is the largest mass of lymphoid tissue in the body

(2) Is located in the upper left quadrant of the abdominal cavity behind the stomach

(3) Is 5-6 inches long and 2-3 inches wide

(4) Is soft, spongy, purplish in color, and has an unusually large blood supply considering its size

Note: The spleen is not a vital organ and can be removed. Other body parts, such as the liver and bone marrow, can compensate for it. However, a person without a spleen is more susceptible to certain infections.

Information Sheet

D. Functions

(1) In the embryo, it produces erythrocytes (red blood cells).

(2) In the adult, it forms only lymphocytes and monocytes.

(3) Filters cancer cells and other particulate matter

(4) Filters and destroys bacteria and worn out red blood cells

(5) Contains plasma cells which produce antibodies

(6) Stores blood (about 350 cc) which can be returned to the bloodstream in case of hemorrhage or other emergency

Lymphatic System
Unit 10

Student Supplement 1—Complete Statements Concerning the Lymphatic System

Name ____

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

______ 1. T cells are produced in the

a. Liver
b. Spleen
c. Kidney
d. Thymus

______ 2. The production of thymosin is important in which age group?

a. Fetal life
b. Adolescence
c. Middle age
d. Old age

______ 3. An organ that shrinks in size after puberty is the

a. Lacteal
b. Spleen
c. Thymus
d. Tonsil

______ 4. Which tonsils are popularly known as the adenoids?

a. Palatine
b. Lingual
c. Nasopharyngeal
d. None of the above

______ 5. A structure that is essential in the development of immunity very early in life is the

a. Thymus
b. Tonsils
c. Spleen
d. Liver

Student Supplement 1

______ 6. The lymph nodes located in the neck which drain parts of the head and neck are the

a. Axillary
b. Inguinal
c. Cranial
d. Cervical

______ 7. A temporary function of the fetal spleen is the production of

a. Eosinophils
b. Erythrocytes
c. Lymphocytes
d. Monocytes

______ 8. Tissue fluid is called lymph when it enters the

a. Thoracic duct
b. Lymph capillaries
c. Cisterna chyli
d. Veins

______ 9. Masses of lymphatic tissue located beneath the mucous membranes are lymph ____________.

a. Axillaries
b. Nodules
c. Capillaries
d. Nodes

______10. The lymph nodes which filter lymph from the legs are the ____________ nodes.

a. Cervical
b. Inguinal
c. Axillary
d. Thoracic

______11. White blood cells produced by the lymph nodes, nodules, and the spleen are

a. Lymphocytes and neutrophils
b. Basophils and lymphocytes
c. Lymphocytes and monocytes
d. Neutrophils and T cells

Student Supplement 1

______12. The spleen is located inferior to the

a. Stomach
b. Liver
c. Diaphragm
d. Colon

______13. The final destination of filtered lymph is the

a. Digestive system
b. Lymphatic system
c. Circulatory system
d. Spleen

______14. The largest mass of lymphoid tissue in the body is the

a. Spleen
b. Brain
c. Thyroid
c. Thymus

______15. Which lymph duct drains the larger area of the body?

a. Right lymphatic duct
b. Left lymphatic duct
c. Thoracic duct
d. Thymus duct

______16. Lymphadenitis is the infection of the

a. Spleen
b. Lymph vessels
c. Lymph nodes
d. Lymph ducts

______17. The cisterna chyli is located in the

a. Small intestines
b. First part of the thoracic duct
c. Spleen
d. Tonsils

Student Supplement 1

______18. Lymph most closely resembles

a. Plasma
b. Blood
c. Chyle
d. Chyme

______19. Lymph is moved by

a. The heart
b. The lymphatic pump
c. Gravity
d. Breathing and skeletal muscle contractions

______20. All of the following statements are true about lymph capillaries EXCEPT

a. They do not bridge two larger vessels.
b. They carry lymph from tissue spaces to larger lymph vessels.
c. They consist of one layer of flattened epithelial cells.
d. They carry lymph from lymph nodes to lymph ducts.

______21. Lymph vessels have how many layers?

a. 1
b. 2
c. 3
d. 4

______22. The thoracic duct empties into the

a. Left subclavian vein
b. Right subclavian vein
c. Inferior vena cava
d. Superior vena cava

______23. Cancer cells from the breast are most likely to first metastasize to the

a. Iliac nodes
b. Axillary nodes
c. Cervical nodes
d. Inguinal nodes

Student Supplement 1

______24. A tonsillectomy is the surgical removal of the ____________ tonsils.

a. Lingual
b. Nasopharyngeal
c. Palatine
d. Esophageal

______25. Because of the spleen's functions, it could also be considered part of which body system other than the lymphatic system?

a. Circulatory
b. Digestive
c. Urinary
d. Endocrine

Respiratory System
Unit 11

Objective Sheet

Unit Objective

After completing this unit, the student should be able to identify parts of the respiratory system and complete statements concerning their functions and characteristics. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the respiratory system with their correct definitions.
2. State the purpose of the respiratory system.
3. Complete statements concerning characteristics of respiration and breathing.
4. Identify the parts of the respiratory system.
5. Select true statements concerning characteristics of the nose.
6. Select functions of the nose.
7. Complete statements concerning the accessory structures of the nose.
8. Complete statements concerning the pharynx.
9. Distinguish between the divisions of the pharynx.
10. Complete statements concerning the larynx.
11. Select true statements concerning the trachea.
12. Select true statements concerning the bronchi.
13. Complete statements concerning the lungs.
14. Identify the lobes of the lungs.
15. Select functions of the lungs.
16. Complete statements concerning the pleura.

Objective Sheet

17. Match divisions of the thorax with the correct definitions.

18. Complete statements concerning the muscles which change the size of the thorax.

19. Match signs and symptoms of pulmonary impairment and breathing disturbances with the correct definitions.

Respiratory System
Unit 11

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Process of Breathing (Objective 3)
   TM 2—The Respiratory System (Objective 4)
   TM 3—Alveoli (Objective 12)
   TM 4—Exchange of Oxygen and Carbon Dioxide (Objective 13)
   TM 5—Pleura (Objective 16)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.
13. Make copies of the written test. Add or modify test items as needed.
14. Give written test.
15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.
16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Show available films concerning the respiratory system.
2. Demonstrate the anatomy and physiology of the respiratory system using illustrations or models.
3. Invite a respiratory therapist to bring equipment to class for demonstrations.
4. Discuss common respiratory complications occurring during surgery.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis, MO: C. V. Mosby Company, 1987.
2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.
3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.
4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Brochures and other supplementary information are available from the following organizations:

   a. American Lung Association
   1740 Broadway
   New York, NY 10019
   212-315-8700

   b. American Medical Association
   515 North State Street
   Chicago, IL 60610
   312-464-5000

2. Videotape—*I Am Joe's Lung*, part of the *I Am Joe's* Series available from several sources. Two companies offering this series include the following:

   a. Medcom/Trainex
   Box 3225
   Garden Grove, CA 92641
   800-877-1443

   b. Pyramid Film and Video
   P.O. Box 1048
   Santa Monica, CA 90406-1048
   800-421-2304

3. Software program—*The Respiratory System* (Module 4) part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

4. Audiotape—*Respiratory and Nervous Systems*, part of the *Medical Terminology Made Easy* Series of audiotapes available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

Suggested Activities

5. Anatomy charts and models on the respiratory system are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
   P.O. Box 21207
   Waco, TX 76702-1207
   800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
   3823 Leavenworth Street
   Omaha, NB 68105
   800-228-7117

Respiratory System
Unit 11

Answers to Student Supplements

Student Supplement 1

a. Lungs
b. Intercostal muscles
c. Bronchi
d. Pharynx
e. Nose or nasal cavity
f. Larynx
g. Trachea
h. Diaphragm

Student Supplement 2

a. Right lower lobe (RLL)
b. Right middle lobe (RML)
c. Right upper lobe (RUL)
d. Left upper lobe (LUL)
e. Left lower lobe (LLL)

Student Supplement 3

1. a
2. a
3. b
4. d
5. d
6. b
7. b
8. b
9. b
10. b
11. a
12. c
13. b
14. d
15. b
16. b
17. b
18. a
19. c
20. d
21. b
22. b
23. d
24. c
25. a
26. a
27. d
28. c
29. a
30. c
31. b
32. b
33. d
34. c

Respiratory System
Unit 11

Answers to Written Test

1. a. 5
   b. 6
   c. 4
   d. 7
   e. 3
   f. 1
   g. 7

2. To bring air and blood into intimate contact so that oxygen can be added to the blood and carbon dioxide can be removed

3. a. Carbon dioxide
   b. Pulmonary
   c. Minute
   d. Breathing
   e. Expiration
   f. Medulla oblongata and pons

4. a. Lungs
   b. Intercostal muscles
   c. Bronchi
   d. Pharynx
   e. Nose
   f. Larynx
   g. Trachea
   h. Diaphragm

5. d, f, g

6. a, c, e, f

7. a. Nasal cavities
   b. Eustachian tube
   c. Nasolacrimal

8. a. Esophagus
   b. Anterior
   c. Muscle
   d. Digestive
   e. Vowel
   f. Throat
   g. Three

Answers to Written Test

9. a. O e. N
b. L f. O
c. N g. N
d. O h. N

10. a. Voice box
b. Air
c. Pharynx
d. Triangular
e. Cartilage
f. Adam's apple
g. Food
h. Under
i. Glottis

11. c, e, f, g

12. b, c, g, i, j, k

13. a. Respiration
b. Pleural
c. Float
d. Diaphragm
e. Heart
f. All structures entering and leaving the lung
g. Upper, clavicle
h. Inferior, diaphragm
i. Left
j. Right
k. Pink, gray
l. 500 cc.
m. Gaseous

14. a. Right upper lobe (RUL)
b. Right middle lobe (RML)
c. Right lower lobe (RLL)
d. Left upper lobe (LUL)
e. Left lower lobe (LLL)

15. a, c d

16. a. Parietal
b. Visceral
c. Pleural
d. Lubricant
e. Excess

Answers to Written Test

17. a. 3
    b. 2
    c. 1

18. a. (1) Dome
       (2) Breathing
       (3) Downward
       (4) Upward
       (5) Esophagus
       (6) Sneezing
    b. (1) Elevate
       (2) Depress

19. a. 5
    b. 6
    c. 2
    d. 7
    e. 9
    f. 3
    g. 8
    h. 1
    i. 10

Respiratory System
Unit 11

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______ a. Depression where ducts, nerves, or vessels enter or exit an organ

______ b. A collection of air or gas in the pleural cavity characterized by pain in side and painful breathing; can lead to the collapse of the lung

______ c. Bloody fluid in the pleural cavity

______ d. The common head cold characterized by acute inflammation of the nasal mucosa

______ e. Accumulation of a fluid in a cavity or matter that penetrates through vessel walls into adjoining tissue

______ f. Exterior nostrils

______ g. Openings between the nasal cavity and the nasopharynx

1. Anterior nares
2. Coryza
3. Exudate
4. Hemothorax
5. Hilum
6. Pneumothorax
7. Posterior nares
8. Respiratory system

2. State the purpose of the respiratory system.

____

____

3. Complete the following statements concerning characteristics of respiration and breathing by filling in the blanks with the correct answers.

   a. Respiration is defined as the taking in of oxygen, its use in the tissues, and the giving off of ______________.

   b. There are two types of respiration: External and Internal. External respiration is also called ______________ respiration. Internal respiration is also called cellular respiration.

Written Test

c. Normal respirations occur about 14 to 20 times per ________________.

d. Respiration is also called the act of ________________ although they are *not* the same.

e. Breathing involves two processes: Inspiration and ________________.

f. Breathing is controlled by the ________________ and the ________________ which are located in the brainstem.

4. Identify the parts of the respiratory system and place your answers in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

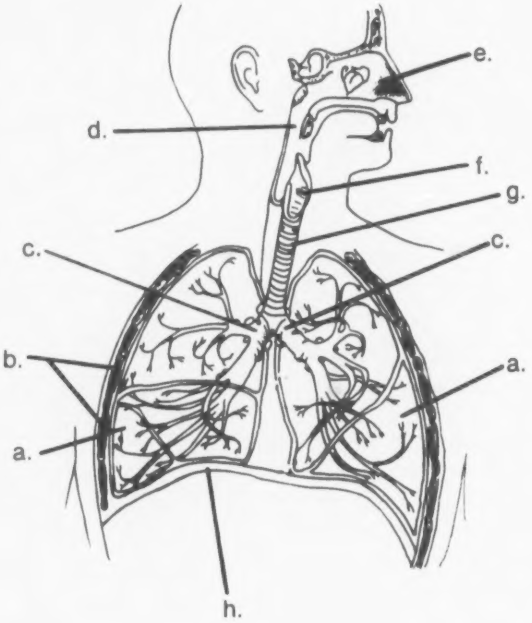
d. ______________________

e. ______________________

f. ______________________

g. ______________________

h. ______________________



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Written Test

5. Select true statements concerning characteristics of the nose by placing an "X" next to the true statements.

_____a. Consists of four nasal cavities

_____b. The openings in the front are known as nostrils or posterior nares.

_____c. Nasal cavities lie between the roof and floor of the mouth.

_____d. Nasal cavities are separated by a vertical partition known as the nasal septum.

_____e. The nasal cavities are constructed of ligaments covered by serous membranes.

_____f. At the side walls are three projections known as nasal conchae, or turbinates, which greatly increase the surface area over which the air must travel before reaching the lungs.

_____g. Mucous membranes of the nose are very vascular because they contain many blood vessels which bring warmth and moisture to the surface.

6. Select functions of the nose by placing an "X" next to the correct functions.

_____a. Warms, moistens, and filters the air of impurities

_____b. Changes carbon dioxide to carbon monoxide

_____c. Serves as a passageway for air going to the lungs

_____d. Serves as an organ of taste

_____e. Serves as an organ of smell

_____f. Aids in phonation, especially of n, m, and ng

7. Complete the following statements concerning the accessory structures of the nose by filling in the blanks with the correct answers.

a. Sinuses — Cavities lined with ciliated mucous membranes that open into the _______________

b. _______________ — Opens into the nasopharynx, and equalizes the air pressure between the external and the middle ear

c. _______________ ducts — Communicate indirectly with the lacrimal gland

Written Test

8. Complete the following statements concerning the pharynx by circling the correct answers.

   a. Is a muscular tube-like structure, about 5 inches long which extends from the base of the skull to the (bronchus, esophagus)

   b. Lies (anterior, posterior) to the cervical vertebrae

   c. Is composed of (muscle, bone) lined with mucous membrane

   d. Serves as a passageway for both the respiratory and (circulatory, digestive) tracts

   e. Plays an important part in phonation especially in producing the different (consonant, vowel) sounds

   f. Is referred to as the (throat, windpipe)

   g. Has (two, three) divisions

9. Distinguish between the divisions of the pharynx by placing the following letters next to the appropriate descriptions: "N" for nasopharynx, "O" for oropharynx, and "L" for laryngopharynx.

   ______a. Middle portion

   ______b. Lower portion

   ______c. Upper portion

   ______d. Contains two sets of tonsils

   ______e. Contains pharyngeal tonsils (adenoids)

   ______f. Lies behind the mouth and between the palate and hyoid bone

   ______g. Lies behind the nose and above the palate

   ______h. Communicates with the eustachian tube

Written Test

10. Complete the following statements concerning the larynx by circling the correct answers.

    a. The organ of voice; also called the (voice box, vocal cord)

    b. Acts as a passageway for (food, air) between pharynx and trachea

    c. Lies at the upper end of the trachea and just below the (pharynx, nasal cavity)

    d. Is shaped like a (square, triangular) box with flat sides and a prominent ridge in front

    e. Consists of nine pieces of (bone, cartilage) which are connected by ligaments and are moved by various muscles

    f. Thyroid cartilage forms (signet ring, Adam's apple).

    g. Epiglottis covers entrance into larynx when swallowing, thus preventing (air, food) from entering the larynx.

    h. Contains two pairs of bands (cords) — False vocal cords that lie along the sides of the larynx and true vocal cords that lie directly (under, over) the false vocal cords

    i. The (epiglottis, glottis) is the space between the vocal folds.

11. Select true statements concerning the trachea by placing an "X" next to the true statements.

______a. Also called the throat

______b. Extends from the lower edge of the larynx to the alveolus

______c. Is about 11 cm. (4½ inches) in length and about 2 to 2.5 cm. (1 inch) from side to side

______d. Is a tube of smooth bone strengthened and held open by 5 C-shaped rings of hyaline cartilage; the open portion of the C-shape is toward the anterior side which lies next to the esophagus

______e. Is lined with mucous membrane

______f. Provides an open passageway for air from the larynx to the bronchi of the lungs

______g. Obstruction for even a few minutes can cause death from asphyxiation.

Written Test

12. Select true statements concerning the bronchi by placing an "X" next to the true statements.

______a. Consist of four primary bronchi

______b. The right bronchus is shorter and more vertical than the left bronchus.

______c. The structure of the bronchi resembles the trachea, as the walls contain cartilage rings and ciliated mucous lining.

______d. Each bronchus enters the lung at the notch or depression on the medial surface called the vagus.

______e. Each primary bronchi enters the lung on its respective side and immediately subdivides into smaller branches called bronchioles.

______f. The bronchioles divide into secondary bronchi.

______g. The bronchioles subdivide into smaller and smaller tubes, eventually ending in microscopic branches which divide into alveolar ducts, which end in several alveolar sacs consisting of numerous alveoli.

______h. The trachea, the two primary bronchi, and their many branches resemble an inverted U, and are spoken of as the bronchial U.

______i. Alveolar ducts and sacs look like a cluster of grapes, with the stem as the alveolar duct, each cluster as an alveolar sac, and each grape as an alveoli.

______j. Bronchi provides a passageway by which air can reach the alveoli of the lungs.

______k. The alveoli (enveloped by a network of capillaries) provide spaces where gaseous exchange between the air and the blood can occur.

Written Test

13. Complete the following statements concerning the lungs by circling the correct answers.

   a. Are the essential organs of (circulation, respiration)

   b. Are cone-shaped and large enough to fill the (cardiac, pleural) portion of the thoracic cavity

   c. Are spongy, elastic, and (sink, float) in water

   d. The two lungs sit side-by-side and extend from the (stomach, diaphragm) to a point slightly above the clavicles, and lie against the ribs anteriorly and posteriorly.

   e. The medial surface of each lung is concave to allow room for the mediastinal structure and the (heart, stomach).

   f. The lung root is composed of (all structures entering and leaving the lung, nerves only).

   g. Apex of the lung is the pointed (lower, upper) margin which extends slightly above the (clavicle, diaphragm).

   h. Base of the lung is the broad (inferior, superior) surface which lies on the (clavicle, diaphragm).

   i. The (left, right) lung has an indentation for the heart called the cardiac notch or depression.

   j. The (left, right) lung is slightly larger, heavier, and shorter by about one inch than the other side.

   k. At birth the lungs are (pink, gray) but with increasing age they become a mottled, (pink, gray) color due to the inhalation of dust, pollution, and smoke.

   l. When filled to capacity, the lungs can hold about 4,500 cc. of air, but only (500 cc., 3,500 cc.) is inhaled and exhaled in a normal breath.

   m. The lungs contain the alveoli which are essential for (water, gaseous) exchange.

Written Test

14. Identify the lobes of the lungs and place your answers in the blanks provided.

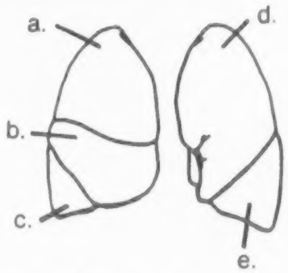
a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________



15. Select functions of the lungs by placing an "X" next to the correct functions.

_____a. Act as essential organs for respiration by distributing air throughout the lungs into the alveoli

_____b. Act as a secretory organ by releasing lung hormones

_____c. Act as an excretory organ because an individual loses about 400 cc. of moisture per day in expired air

_____d. Furnish a place where air can come in close enough contact with blood for gaseous exchange to occur

16. Complete the following statements concerning the pleura by circling the correct answers.

a. (Visceral, Parietal) pleura is a serous membrane which contains the lungs and lines the thoracic cavity; each side has its own pleural lining.

b. (Visceral, Parietal) pleura covers the outer surface of each lung.

c. (Bronchial, Pleural) space is the potential space formed by the visceral and parietal pleura lying adjacent to each other which contains pleural fluid.

d. Pleural fluid is secreted by the serous membranes to act as a (coolant, lubricant).

e. (Insufficient, Excess) secretion of pleural fluid results in pleural effusion.

17. Match divisions of the thorax on the right with the correct definitions.

_____a.	Area occupied by the lungs	1. Pericardium
_____b.	Space between the lungs	2. Mediastinum
_____c.	Area occupied by the heart	3. Pleural cavities

Written Test

18. Complete the following statements concerning the muscles which change the size of the thorax by filling in the blanks with the correct answers.

a. Diaphragm

(1) ____________________ shaped muscle

(2) Primary muscle involved in ____________________

(3) On inspiration, it contracts, flattens, and moves ____________________ to enlarge the thoracic cavity.

(4) On expiration, it relaxes, moving ____________________ to decrease the size of the thoracic cavity.

(5) Has three hiatuses or openings — ____________________, aorta, and inferior vena cava

(6) Becomes spasmodic in hiccoughs and ____________________

b. Intercostal muscles

(1) External intercostals ____________________ the ribs.

(2) Internal intercostals ____________________ the ribs.

19. Match signs and symptoms of pulmonary impairment and breathing disturbances on the right with the correct definitions.

______a. Refers to ordinary quiet respirations made without obvious effort

______b. Painful, difficult, and labored breathing

______c. Increased rate and/or depth of respirations

______d. Cessation of breathing or lack of breathing

______e. Lack of oxygen or absence of oxygen

______f. Decreased amount of oxygen reaching the body cells

1. Asphyxia
2. Hyperpnea
3. Hypoxia
4. Cyanosis
5. Eupnea
6. Dyspnea
7. Apnea
8. Suffocation
9. Anoxia
10. Cheyne-Stokes

Written Test

_____g. Any stoppage of respirations caused by strangulation, aspiration of foreign object, or drowning

_____h. Increased CO_2 and decreased O_2 in the body as a result of some interference with respiration

_____i. Alternating cycles of hyperpnea and apnea, often seen in critically ill or unconscious patients

***Permission to duplicate this test is granted.**

Respiratory System
Unit 11

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

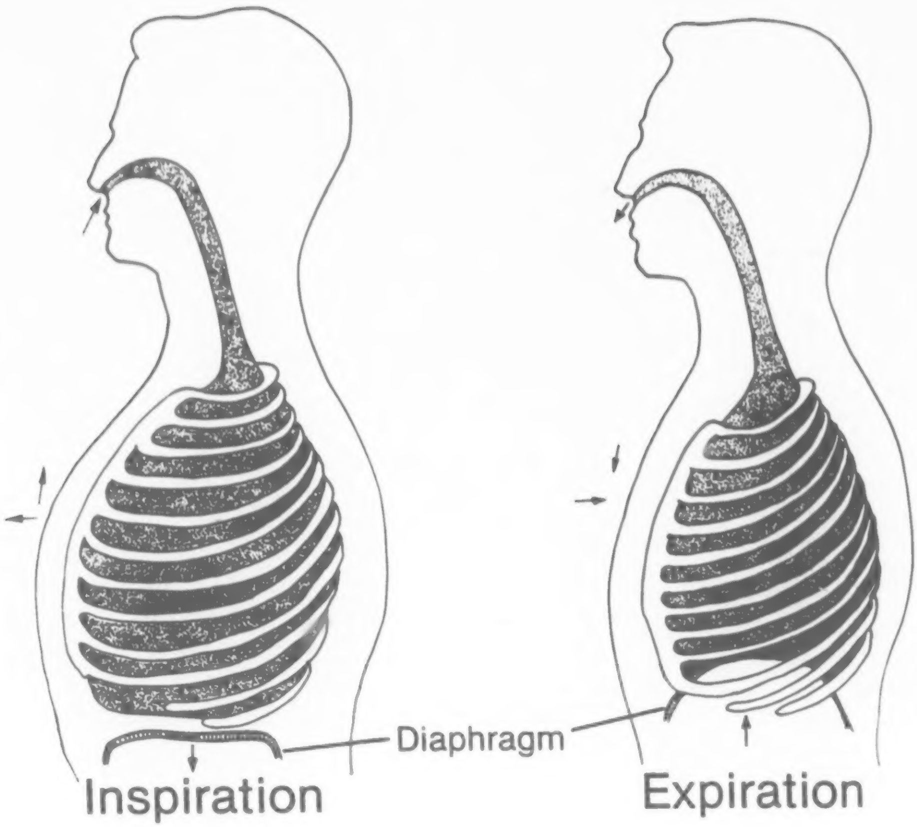
____

Teacher Signature ______________________________ Date __________

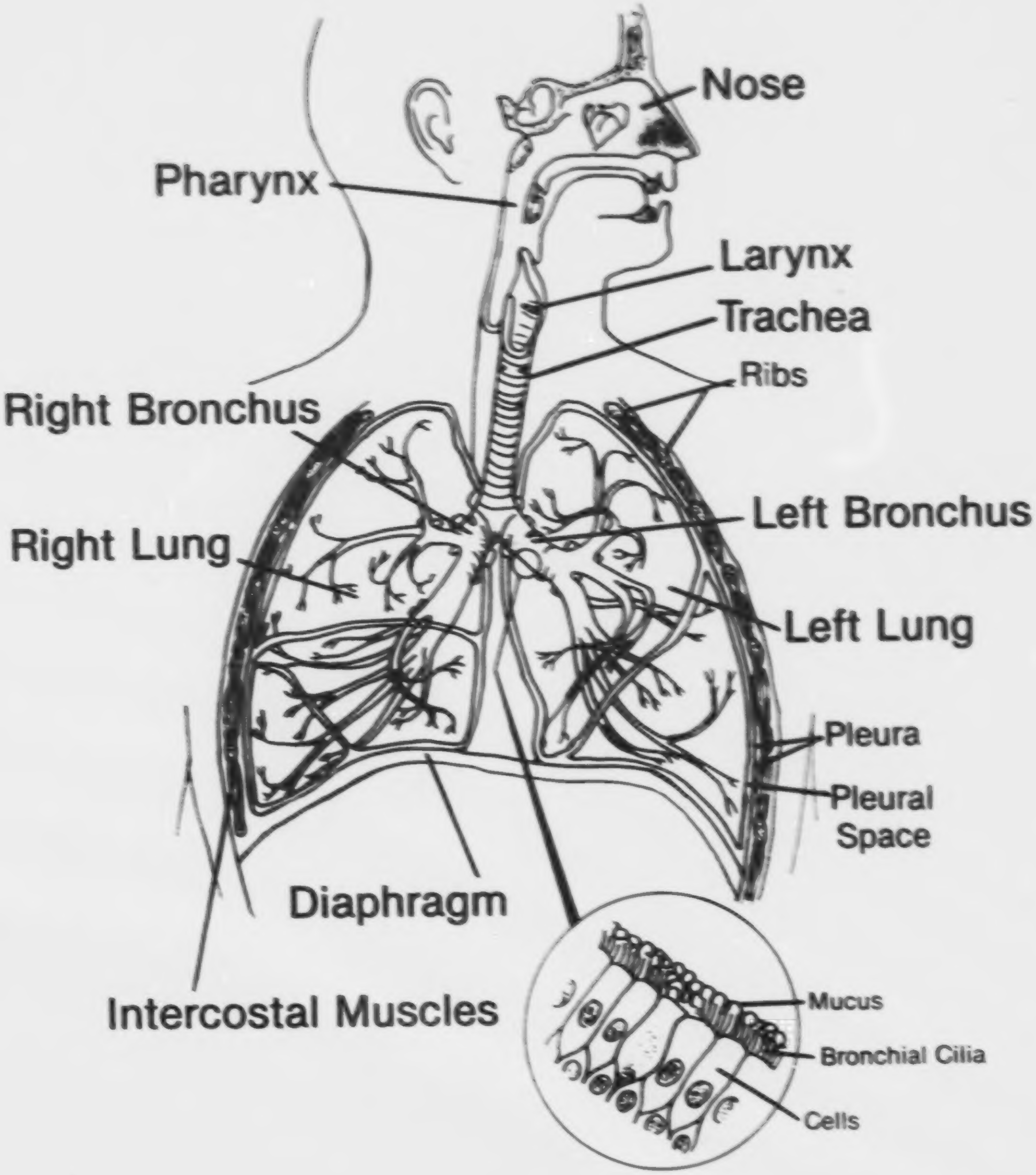
Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.

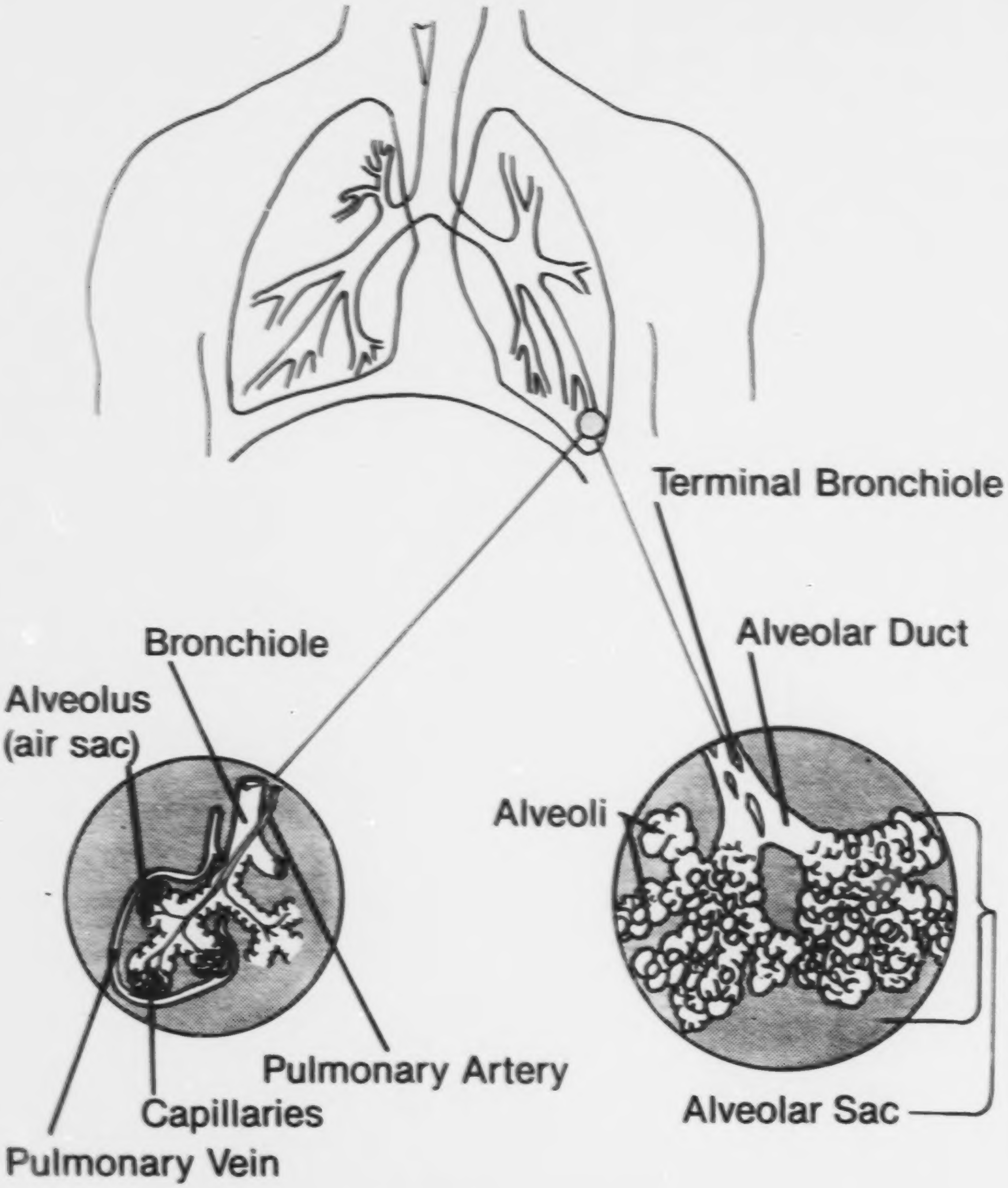
Process of Breathing


Diaphragm
Inspiration
Expiration

The Respiratory System


Nose
Pharynx
Larynx
Trachea
Ribs
Right Bronchus
Left Bronchus
Right Lung
Left Lung
Pleura
Pleural Space
Diaphragm
Intercostal Muscles
Mucus
Bronchial Cilia
Cells

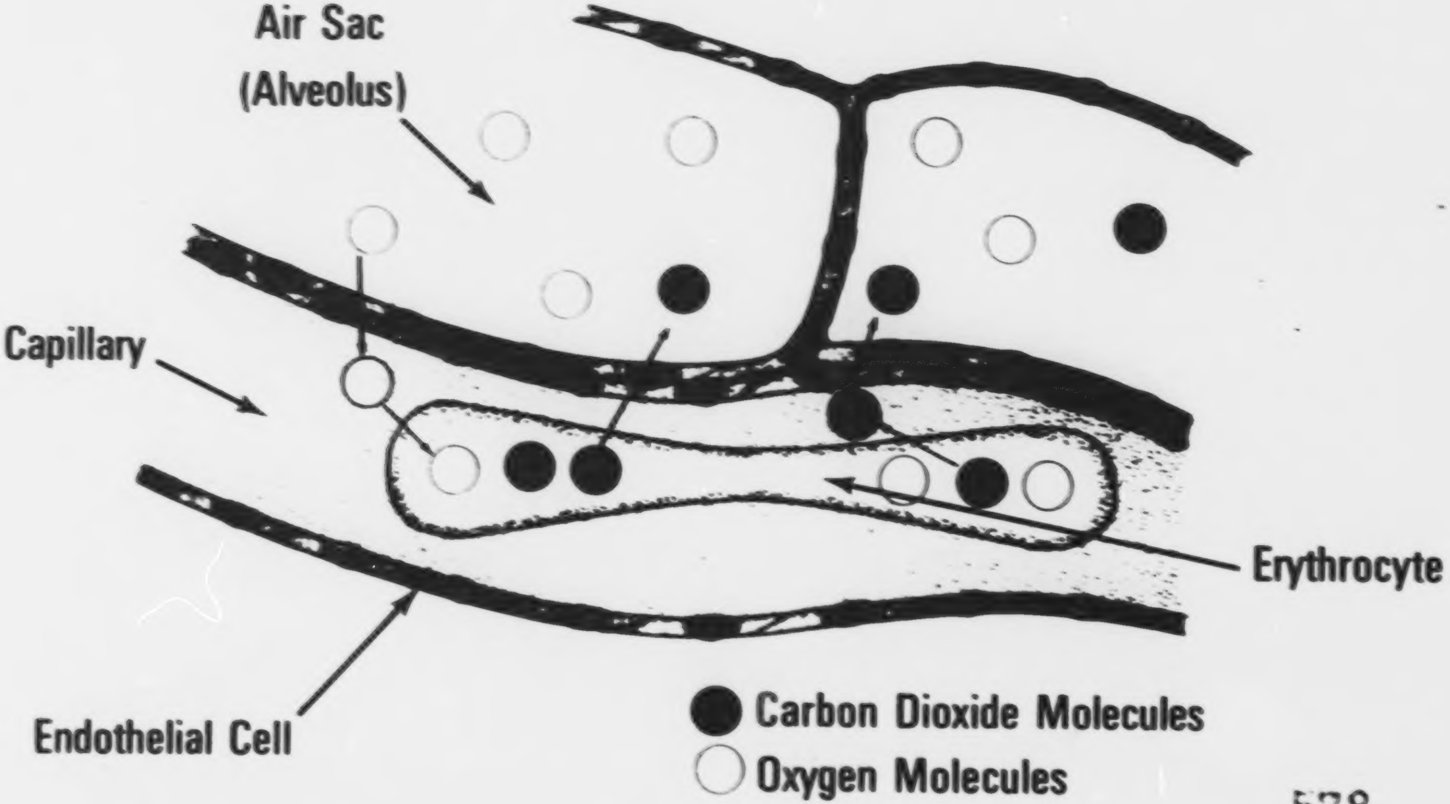
Alveoli



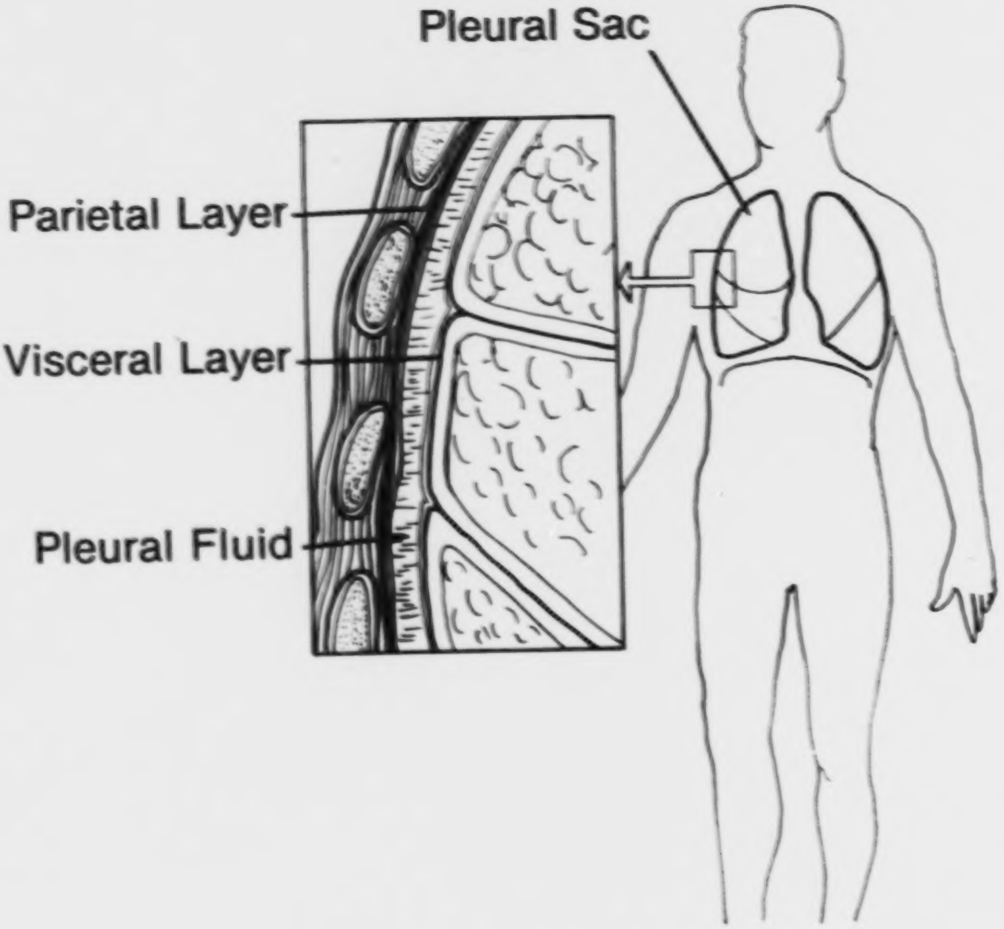
Terminal Bronchiole
Bronchiole
Alveolar Duct
Alveolus
(air sac)
Alveoli
Pulmonary Artery
Capillaries
Alveolar Sac
Pulmonary Vein

Enlarged Sections of the Lung

Exchange of Oxygen and Carbon Dioxide


Air Sac
(Alveolus)
Capillary
Erythrocyte
Endothelial Cell
● Carbon Dioxide Molecules
○ Oxygen Molecules

Pleura


Pleural Sac
Parietal Layer
Visceral Layer
Pleural Fluid

Respiratory System
Unit 11

Information Sheet

1. **Terms and definitions**

   a. **Anterior nares** — Exterior nostrils

   b. **Coryza** — The common head cold characterized by acute inflammation of the nasal mucosa

   c. **Exudate** — Accumulation of a fluid in a cavity or matter that penetrates through vessel walls into adjoining tissue

   d. **Hemothorax** — Bloody fluid in the pleural cavity

   e. **Hilum** — Depression where ducts, nerves, or vessels enter or exit an organ

   f. **Pneumothorax** — A collection of air or gas in the pleural cavity characterized by pain in side and painful breathing; can lead to the collapse of the lung

   g. **Posterior nares** — Openings between the nasal cavity and the nasopharynx

2. **Purpose of the respiratory system** — To bring air and blood into intimate contact so that oxygen can be added to the blood and carbon dioxide can be removed

   Note: The respiratory system is considered essential for life because without oxygen the body's cells cannot survive. The respiratory and the circulatory systems are almost considered as one, because one cannot function without the other. They share the responsibility for delivering oxygen to the body's cells and carrying waste products away.

3. **Characteristics of respiration and breathing**

   a. Respiration is defined as the taking in of oxygen, its use in the tissues, and the giving off of carbon dioxide.

   b. There are two types of respiration:

      (1) External respiration

         (a) Process of taking air into the lungs and passing oxygen from the alveoli (air sac) into the blood
         (b) Also called pulmonary respiration

Information Sheet

(2) Internal respiration

(a) Process of passing oxygen from the blood into the cells, its utilization by the cells, and passing carbon dioxide from cells into the blood

(b) Also called cellular respiration

c. Normal respirations occur about 14 to 20 times per minute.

d. Respiration is also called the act of breathing, although respiration and breathing are *not* the same.

(1) Breathing is the mechanical movement of the chest and diaphragm resulting in the flow of air into and out of the lungs.

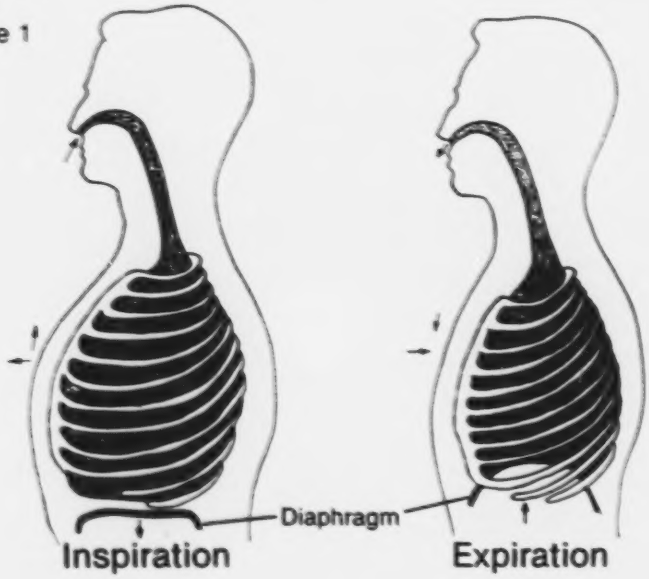
(2) Respiration includes more; it is breathing as well as the utilization of oxygen and production of carbon dioxide by the body cells.

e. Breathing involves two processes:

(1) Inspiration — Inhaling air

(2) Expiration — Exhaling air

Figure 1



Information Sheet

f. Breathing is controlled by the medulla oblongata and the pons which are located in the brainstem.

  (1) Brain sends impulses down the spinal cord to the phrenic nerve which innervates the diaphragm.

  (2) If the brainstem is severely injured, if the spinal cord is severed in the cervical area, or if the phrenic nerve is severed, respirations will cease.

  (3) The medulla is governed by variations in the chemistry of the blood which are detected by chemoreceptors in the carotid body and the aortic arch.

  (4) The major regulator of respiration is the carbon dioxide level in the blood.

    (a) A high CO_2 level will stimulate respirations to allow the CO_2 to be exhaled and O_2 to enter the bloodstream.
    (b) A low CO_2 level will decrease the respiratory rate.

4. **Parts of the respiratory system** (Figure 2)

Note: Because the lungs are incapable of independent movement, other structures are necessary for the intake of air and expansion of the lungs.

a. Nose

b. Pharynx

c. Larynx

d. Trachea

e. Bronchi

f. Lungs

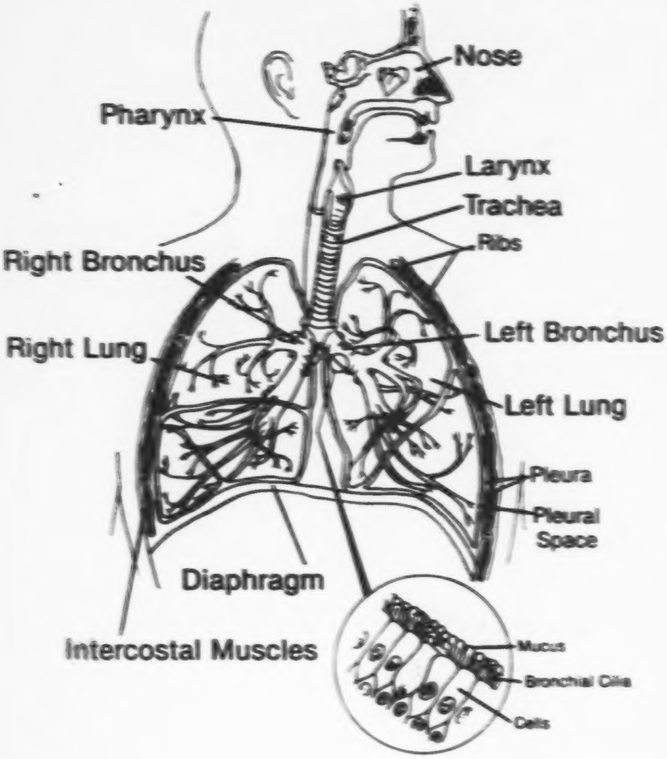
Note: The entire respiratory cavity is lined with ciliated mucous membrane.

g. Muscles of respiration

  (1) Diaphragm

  (2) Intercostal muscles

Figure 2


Nose
Pharynx
Larynx
Trachea
Ribs
Right Bronchus
Right Lung
Left Bronchus
Left Lung
Pleura
Pleural Space
Diaphragm
Intercostal Muscles
Mucus
Bronchial Cilia
Cells

5. **Characteristics of the nose**

   a. Consists of two nasal cavities

   b. The openings in the front are known as nostrils or anterior nares.

   c. Nasal cavities lie between the roof of the mouth and the cranium.

   d. Nasal cavities are separated by a vertical partition known as the nasal septum.

   e. The nasal cavities are constructed of bone covered by ciliated mucous membranes.

   f. At the side walls are three projections known as nasal conchae, or turbinates, which greatly increase the surface area over which the air must travel before reaching the lungs.

   g. Mucous membranes of the nose are very vascular because they contain many blood vessels which bring warmth and moisture to the surface.

Information Sheet

6. **Functions of the nose**

   a. Serves as a passageway for air going to the lungs

   b. Warms, moistens, and filters the air of impurities

   c. Serves as an organ of smell

   Note: The receptors are located in the mucosa.

   d. Aids in phonation, especially of n, m, and ng

7. **Accessory structures of the nose**

   a. Sinuses — Cavities lined with ciliated mucous membranes that open into the nasal cavities

   Note: Their function is not known, but some speculate that they warm, moisten, and filter the air as the nasal cavities do.

   (1) Frontal (2)

   (2) Maxillary (2)

   (3) Sphenoidal (2)

   (4) Ethmoidal (2)

   b. Eustachian tube — Opens into the nasopharynx, and equalizes the air pressure between the external and the middle ear

   c. Nasolacrimal ducts — Communicate indirectly with the lacrimal gland

8. **Characteristics of the pharynx**

   a. Is a muscular tube-like structure, about 5 inches long, which extends from the base of the skull to the esophagus

   b. Lies anterior to the cervical vertebrae

   c. Is composed of muscle and is lined with mucous membrane

   d. Serves as a passageway for both the respiratory and digestive tracts

   (1) Passes air from nasal cavity to larynx

   (2) Passes food and liquids from mouth to esophagus

Information Sheet

e. Plays an important part in phonation especially in producing the different vowel sounds

f. Is referred to as the throat

g. Has three divisions

9. **Divisions of the pharynx**

a. Nasopharynx

(1) Upper portion

(2) Lies behind the nose and above the palate

(3) Contains pharyngeal tonsils (adenoids)

(4) Communicates with the eustachian tube

b. Oropharynx

(1) Middle portion

(2) Lies behind the mouth and between the palate and hyoid bone

(3) Contains two sets of tonsils:

(a) Palatine tonsils

Note: These are the tonsils that are removed during a tonsillectomy.

(b) Lingual tonsils (base of tongue)

c. Laryngopharynx

(1) Lower portion

(2) Lies immediately below the hyoid bone and above the larynx

Information Sheet

10. Characteristics of the larynx

a. The organ of voice; also called the voice box

b. Acts as a passageway for air between pharynx and trachea

c. Lies at the upper end of the trachea and just below the pharynx

d. Is shaped like a triangular box with flat sides and a prominent ridge in front

e. Consists of nine pieces of cartilage which are connected by ligaments and are moved by various muscles

f. Three cartilages are prominent:

  (1) Thyroid cartilage — Large cartilage; forms Adam's apple

  Note: It is larger in men than in women.

  (2) Epiglottis — Covers entrance into larynx when swallowing, thus preventing food or liquids from entering the airway

  (3) Cricoid cartilage — Lowest cartilage shaped like a signet ring

g. Contains two pairs of bands (cords):

  (1) False vocal cords — Lie at the upper end along the sides of the larynx

  (2) True vocal cords — Lie directly under the false vocal cords

    (a) Vibrate like reeds of a pipe organ and make the vocal sounds
    (b) Are set into vibration by the flow of air from the lungs
    (c) The glottis is the space (slit) between the vocal folds.

    Note: Because the male larynx is larger, the vocal folds are also larger, which accounts for a difference in pitch.

Information Sheet

11. Characteristics of the trachea

a. Also called the windpipe

b. Extends from the lower edge of the larynx to the bronchi

c. Is about 11 cm. ($4\frac{1}{2}$ inches) in length and about 2 to 2.5 cm. (1 inch) from side to side

d. Is a tube of smooth muscle strengthened and held open by 16 to 20 C-shaped rings of hyaline cartilage; the open portion of the C-shape is toward the posterior side which lies next to the esophagus

e. Is lined with mucous membrane

f. Provides an open passageway for air from the larynx to the bronchi of the lungs

g. Obstruction for even a few minutes can cause death from asphyxiation.

12. Characteristics of the bronchi

a. Consist of two primary bronchi, the right bronchus and the left bronchus

b. The right bronchus is shorter and more vertical than the left bronchus.

c. The structure of the bronchi resembles the trachea, as the walls contain cartilage rings and ciliated mucous lining.

d. Each bronchus enters the lung at the notch or depression on the medial surface called the hilus or hilum.

Note: Blood vessels, nerves, and lymphatics also enter at the same point.

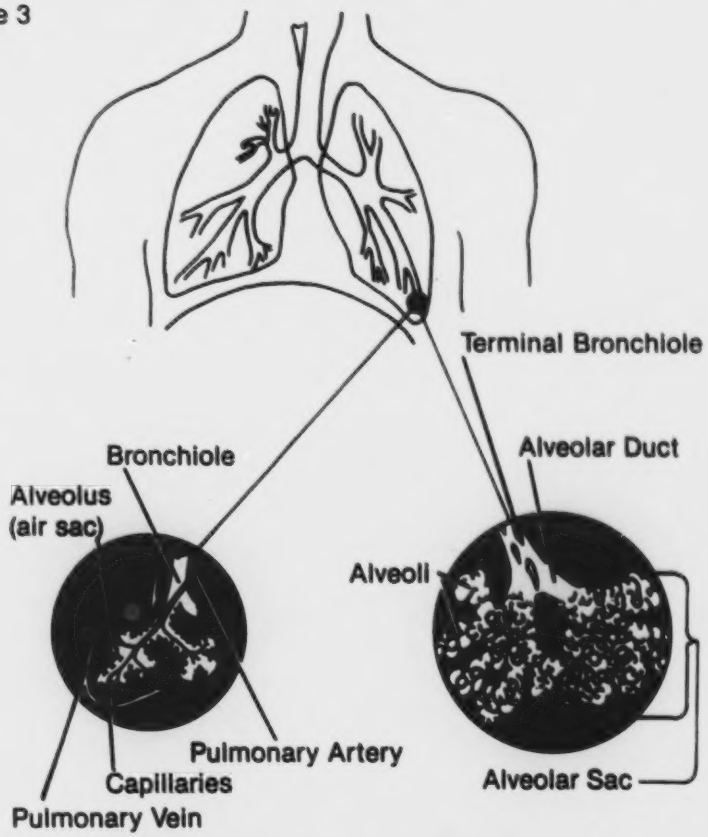
e. Each primary bronchi enters the lung on its respective side and immediately subdivides into smaller branches called secondary bronchi.

f. Secondary bronchi continue to branch forming small bronchioles which lack cartilage.

Information Sheet

g. The bronchioles subdivide into smaller and smaller tubes, eventually ending in microscopic branches which divide into alveolar ducts, which end in several alveolar sacs consisting of numerous alveoli (air cells).

Figure 3


Terminal Bronchiole
Bronchiole
Alveolar Duct
Alveolus
(air sac)
Alveoli
Pulmonary Artery
Capillaries
Alveolar Sac
Pulmonary Vein

Enlarged Sections of the Lung

h. The trachea, the two primary bronchi, and their many branches resemble an inverted tree, and are spoken of as the bronchial tree.

i. By the time the branches of the bronchial tree have dwindled to form alveoli, only the internal surface layer of cells remain.

j. Alveolar ducts and sacs look like a cluster of grapes, with the stem as the alveolar duct, each cluster as an alveolar sac, and each grape as an alveoli.

k. Bronchi provides a passageway by which air can reach the alveoli of the lungs.

l. The alveoli (enveloped by a network of capillaries) provide spaces where gaseous exchange between the air and the blood can occur.

Information Sheet

13. Characteristics of the lungs

a. Are the essential organs of respiration

b. Are cone-shaped and large enough to fill the pleural portion of the thoracic cavity

c. Are spongy, elastic, and float in water

d. The two lungs sit side-by-side and extend from the diaphragm to a point slightly above the clavicles, and lie against the ribs anteriorly and posteriorly.

e. The medial surface of each lung is concave to allow room for the mediastinal structure and the heart.

f. The lung root (the lung's attachment to the mediastinum) is composed of all structures entering and leaving the lung, which includes:

   (1) Primary bronchi

   (2) Pulmonary arteries and veins

   (3) Bronchial arteries and veins

   (4) Lymph vessels and nodes

   (5) Nerves

g. Apex of the lung is the pointed upper margin which extends slightly above the clavicle

h. Base of the lung is the broad inferior surface which lies on the diaphragm.

i. The left lung has an indentation for the heart called the cardiac notch or depression.

j. The right lung is slightly larger, heavier, and shorter by about one inch than the other side.

Information Sheet

k. Blood supply to the lungs' tissue is the bronchial arteries which are branches from the thoracic aorta.

l. At birth the lungs are pink, but with increasing age they become a mottled, gray color due to the inhalation of dust, pollution, and smoke.

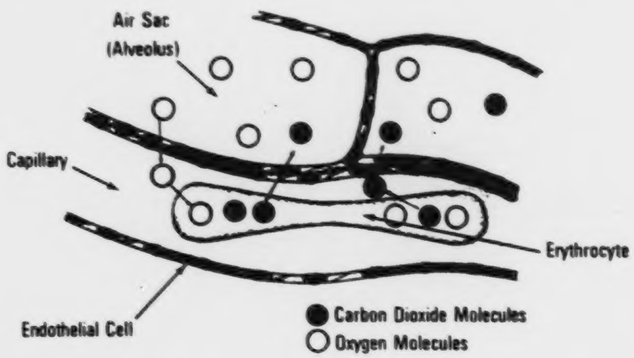
m. When filled to capacity, the lung can hold about 4,500 cc. of air, but only 500 cc. is inhaled and exhaled in a normal breath.

n. The lungs contain the alveoli which are essential for gaseous exchange.

   (1) These thin-walled sacs are enveloped by a network of capillaries (branches of the pulmonary arteries).

   (2) As blood circulates through the capillaries, carbon dioxide diffuses through the cell membrane and is exchanged for oxygen.

Figure 4


Air Sac
(Alveolus)
Capillary
Erythrocyte
Endothelial Cell
● Carbon Dioxide Molecules
○ Oxygen Molecules

Information Sheet

14. Lobes of the lungs

a. Left lung has two lobes:

   (1) Left upper lobe (LUL)

   (2) Left lower lobe (LLL)

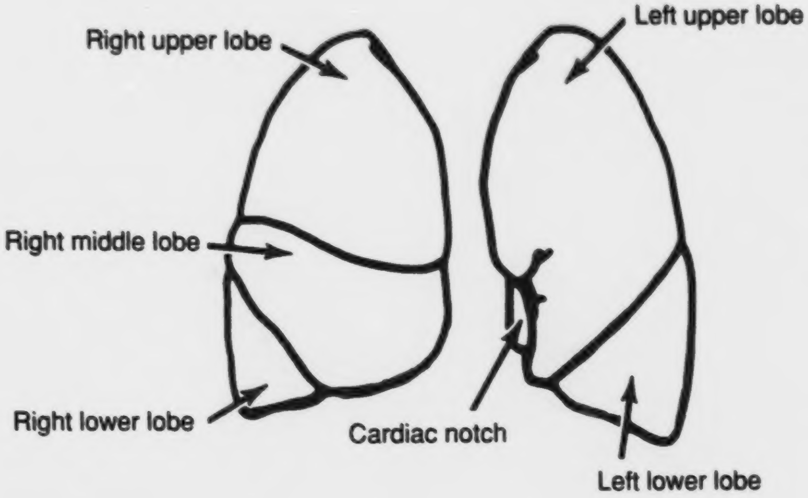
b. Right lung has three lobes:

   (1) Right upper lobe (RUL)

   (2) Right middle lobe (RML)

   (3) Right lower lobe (RLL)

Figure 5


Right upper lobe
Left upper lobe
Right middle lobe
Right lower lobe
Cardiac notch
Left lower lobe

15. Functions of the lungs

a. Act as essential organs for respiration by distributing air throughout the lungs into the alveoli

b. Furnish a place where air can come in close enough contact with blood for gaseous exchange to occur

c. Act as an excretory organ because an individual loses about 400 cc. of moisture per day in expired air

Information Sheet

16. Characteristics of the pleura

a. Parietal pleura is a serous membrane which contains the lungs and lines the thoracic cavity; each side has its own pleural lining.

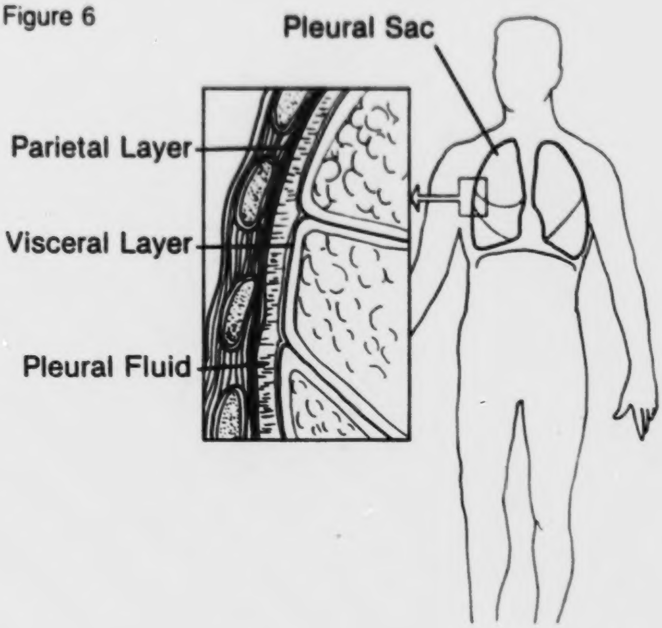
b. Visceral pleura covers the outer surface of each lung.

c. Pleural space is the potential space formed by the visceral and parietal pleura lying adjacent to each other which contains pleural fluid.

d. Pleural fluid is secreted by the serous membranes to act as a lubricant.

e. Excess secretion of pleural fluid results in pleural effusion.

Figure 6



17. Divisions of the thorax (chest cavity)

Note: These three divisions are separated by partitions of pleura.

a. Pleural cavities (2) — Area occupied by the lungs

b. Mediastinum — Space between the lungs

c. Pericardium — Area occupied by the heart

Information Sheet

18. **Muscles which change the size of the thorax**

    a. Diaphragm

        (1) Dome-shaped muscle

        (2) Primary muscle involved in breathing

        (3) On inspiration, it contracts, flattens, and moves downward to enlarge the thoracic cavity.

        (4) On expiration, it relaxes, moving upward to decrease the size of the thoracic cavity.

        (5) Has three hiatuses or openings for

            (a) Esophagus
            (b) Aorta
            (c) Inferior vena cava

        (6) Becomes spasmodic in hiccoughs and sneezing

    b. Intercostal muscles (internal and external)

        (1) External intercostals elevate the ribs.

        (2) Internal intercostals depress the ribs.

19. **Signs and symptoms of pulmonary impairment and breathing disturbances**

    a. **Eupnea** — Refers to ordinary quiet respirations made without obvious effort

    b. **Dyspnea** — Painful, difficult, and labored breathing

    c. **Hyperpnea** — Increased rate and/or depth of respirations

    d. **Apnea** — Cessation of breathing or lack of breathing

    e. **Anoxia** — Lack of oxygen or absence of oxygen

    Note: The body cells are not receiving oxygen.

    f. **Hypoxia** — Decreased amount of oxygen reaching the body cells

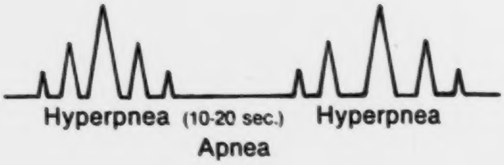
    g. **Suffocation** — Any stoppage of respirations caused by strangulation, aspiration of foreign object, or drowning

Information Sheet

h. **Asphyxia** — Increased CO_2 and decreased O_2 in the body as a result of some interference with respiration

i. **Cheyne-Stokes** — Alternating cycles of hyperpnea and apnea, often seen in critically ill or unconscious patients

Figure 7



j. **Cyanosis** — A bluish gray discoloration of the skin and mucous membranes caused by an insufficient amount of oxygen

Respiratory System
Unit 11

Student Supplement 1—Identify Parts of the Respiratory System

Name ______________________________

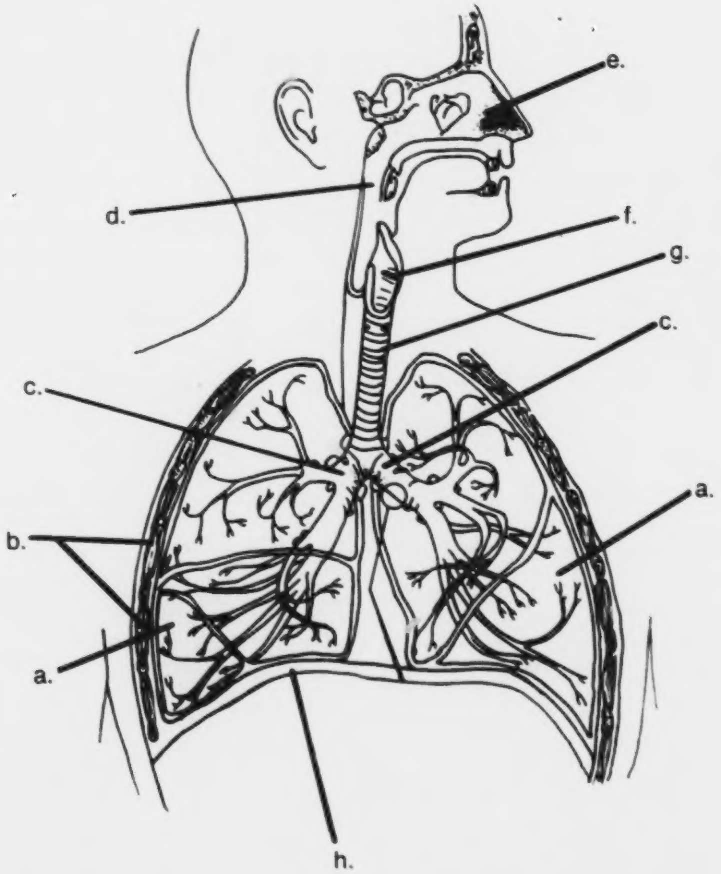
Directions: Identify the parts in the following illustration, and place your answers in the blanks provided.

a. ______________________ e. ______________________

b. ______________________ f. ______________________

c. ______________________ g. ______________________

d. ______________________ h. ______________________



Respiratory System
Unit 11

Student Supplement 2—Identify Lobes of the Lungs

Name ______________________________

Directions: Identify the lobes of the lungs shown in the following illustration, and place your answers in the blanks provided.

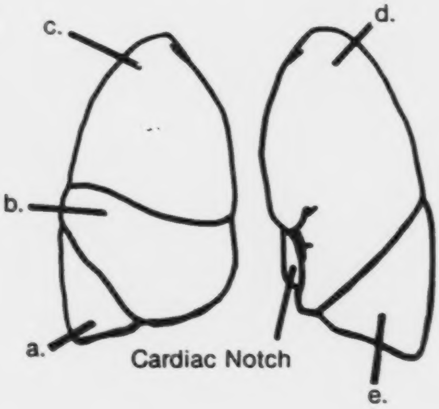
a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________



Respiratory System
Unit 11

Student Supplement 3—Complete Statements Concerning the Respiratory System

Name ____

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

______ 1. The waste product of respiration is

- a. Carbon dioxide
- b. Oxygen
- c. Hydrogen
- d. Carbon monoxide

______ 2. The hair-like projections on the cells lining the respiratory system are called

- a. Cilia
- b. Villi
- c. Projecti
- d. Flagella

______ 3. The use each body cell makes of its oxygen supply is described as

- a. Breathing
- b. Internal respiration
- c. External respiration
- d. Combustion

______ 4. An important function of the alveoli in the respiratory system is

- a. To continue breathing activities
- b. External respiration
- c. To keep the oxygen level in the brain constant
- d. To pass oxygen from the respiratory system into the circulatory system

______ 5. Foods and fluids are kept out of the trachea by the action of the

- a. Tonsils
- b. Esophagus
- c. Hard palate
- d. Epiglottis

Student Supplement 3

______ 6. Paralysis of the diaphragm would cause respiratory difficulty because it would be impossible

a. For the intercostal muscles to contract
b. To increase and decrease the size of the chest cavity
c. For the alveolar muscles to relax
d. To prevent bronchial spasm

______ 7. Faster and deeper respirations are ordered by the respiratory center in the brain when

a. The bronchioles go into spasm
b. Carbon dioxide accumulates in the bloodstream
c. Activity is decreased
d. Accumulated food supplies must be burned

______ 8. The two body systems that share the function for supplying an adequate amount of oxygen to all the cells of the body are the

a. Muscular and respiratory systems
b. Circulatory and respiratory systems
c. Circulatory and skeletal systems
d. Digestive and respiratory systems

______ 9. The secretion produced by the membrane lining of the respiratory tract is called

a. Cilia
b. Mucus
c. Serum
d. Sputum

______10. When the cells of the body are not receiving any oxygen. the condition is called

a. Apnea
b. Anoxia
c. Dyspnea
d. Orthopnea

______11. The vertical size of the chest cavity is increased by the

a. Contraction of the diaphragm
b. Relaxation of the diaphragm
c. Contraction of the lung tissue
d. Relaxation of the lung tissue

Student Supplement 3

______12. The vocal cords are in the

a. Pharynx
b. Trachea
c. Larynx
d. Bronchi

______13. The respiratory tract is lined with

a. Serous membrane
b. Mucous membrane
c. Synovial membrane
d. Connective tissue

______14. Hoarseness or inability to make voice sounds probably would be a result of inflammation or injury of the

a. Trachea
b. Nasal cavities
c. Alveoli
d. Larynx

______15. Adenoids is the common term for the

a. Palatine tonsils
b. Pharyngeal tonsils
c. Tonsillar pillars
d. Lingual tonsils

______16. The system that serves to exchange gases between the air and the blood is known as the

a. Cardiovascular system
b. Respiratory system
c. Genitourinary system
d. Excretory system

______17. Many children with tonsillitis develop an ear infection. This is because the ear and throat are connected by the

a. Larynx
b. Eustachian tube
c. Epiglottis
d. Esophagus

Student Supplement 3

______18. The respiratory center is located in the part of the brain called the

a. Medulla
b. Thalamus
c. Midbrain
d. Cerebellum

______19. Which of the following is **NOT** a function of the nasal passage?

a. Warming and moistening inhaled air
b. Acting as a filter
c. Allowing for absorption of oxygen and carbon
d. Serving as passageways for air

______20. The structure commonly called the throat is the

a. Larynx
b. Trachea
c. Esophagus
d. Pharynx

______21. The exchange of oxygen and carbon dioxide between the outside air and lung capillaries takes place in the

a. Bronchioles
b. Alveoli
c. Trachea
d. Pleura

______22. The large, dome-shaped muscle that separates the thoracic and abdominal cavities is called the

a. Peritoneal fold
b. Diaphragm
c. Intercostal muscle
d. Thoracic muscle

______23. The pleura is the

a. Lower part of the lung
b. Main branch of the bronchial tree
c. Muscle most important in respiration
d. Membrane that lines the chest cavity and covers the outer surface of the lung

Student Supplement 3

______24. The space between the lungs is known as the

a. Pericardium
b. Pleura
c. Mediastinum
d. Epistaxis

______25. The nerve that controls the diaphragm is known as the

a. Phrenic nerve
b. Celiac nerve
c. Polyp nerve
d. Sciatic nerve

______26. The larynx is

a. Usually larger in the male
b. Usually larger in the female
c. The same in both male and female

______27. **All** of the following are true of the trachea **EXCEPT** that

a. It's a tube surrounded by C-shaped rings of cartilage
b. It extends from larynx to bronchi
c. It's lined with cilia
d. It's located above the larynx

______28. The tonsils which are removed during a tonsillectomy are located in the

a. Epiglottic
b. Larynx
c. Pharynx
d. Trachea

______29. The true vocal cords are fibrous bands that stretch across the

a. Larynx
b. Epiglottis
c. Glottis
d. Pharynx

______30. Another name for the chest is the

a. Parietal pleura
b. Mediastinum
c. Thorax
d. Ventral

Student Supplement 3

______31. Another name for the trachea is the

a. Adam's apple
b. Windpipe
c. Voice box
d. Gullet

______32. The base of the lung rests on the

a. Stomach
b. Diaphragm
c. Hilum
d. Primary bronchi

______33. If air is introduced into the pleural space, it is known as

a. Thoracentesis
b. Intrathorax
c. Hemothorax
d. Pneumothorax

______34. The collapse of the whole or part of a lung due to an obstruction of the bronchus is known as

a. Thoracentesis
b. Asphyxiation
c. Atelectasis
d. Emphysema

Reproductive System
Unit 12

Objective Sheet

Unit Objective

After completing this unit, the student should be able to identify reproductive organs and complete statements concerning their functions and characteristics. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the reproductive system with their correct definitions.
2. List functions of the reproductive system.
3. Complete statements concerning the development of the human reproductive organs.
4. List secondary sex characteristics.
5. Match primary and accessory male reproductive glands with the correct descriptions.
6. Match seminal ducts with the correct descriptions.
7. Distinguish between the supporting structures of the male reproductive system.
8. Select true statements concerning the seminal fluid.
9. Select true statements concerning characteristics of the female reproductive system.
10. Identify the female reproductive organs.
11. Complete statements concerning characteristics of the uterus.
12. Select functions of the uterus.
13. Identify the parts of the uterus.
14. Complete statements concerning the normal and abnormal positioning of the uterus.

Objective Sheet

15. Distinguish between the layers of the uterine walls.

16. Match ligaments supporting the uterus with the correct descriptions.

17. Complete statements concerning the characteristics of the uterine tubes.

18. Select functions of the uterine tubes.

19. Select true statements concerning the characteristics of the ovaries.

20. List the two functions of the ovaries.

21. Select true statements concerning the characteristics of the vagina.

22. Complete statements concerning the functions of the vagina.

23. Match female external genitalia with the correct descriptions.

24. Complete statements concerning the breasts.

25. Match the phases of the menstrual cycle with the correct characteristics.

26. Complete statements concerning characteristics of menstruation.

27. Match menstrual irregularities with the correct descriptions.

28. Complete statements concerning the characteristics of pregnancy.

Reproductive System
Unit 12

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Ovum and Sperm (Objective 1)
   TM 2—Male Reproductive System (Objective 5)
   TM 3—Female Reproductive System (Objective 10)
   TM 4—Internal Female Genitalia (Objective 10)
   TM 5—External Female Genitalia (Objective 10)
   TM 6—The Uterus (Objective 13)
   TM 7—The Breast (Objective 24)
   TM 8—The Menstrual Cycle (Objective 25)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.
13. Make copies of the written test. Add or modify test items as needed.
14. Give written test.
15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.
16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Show available films concerning the reproductive system. **Skill area: Communication**
2. Demonstrate the anatomy of the male and female reproductive systems using illustrations or wall charts.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.
2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.
3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.
4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Videotapes

   a. *Miracle Months*

   b. *The Sexes*

   c. *The Sexes II*

   a-c are part of *The Body Human* Series available from:

   Medcom/Trainex
   Box 3225
   Garden Grove, CA 92641
   800-877-1443

   d. *Shares in the Future*

   e. *Coming Together*

   f. *A New Life*

   g. *Into the World*

   d-g are part of *The Living Body* Series available from:

   Films for the Humanities and Sciences
   P.O. Box 2053
   Princeton, NJ 08543-2053
   800-257-5126 or 609-452-1128

2. Software program—*The Reproductive System* (Module 12), part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

Suggested Activities

3. Audiotape—*Birth and the Female Reproductive System*, part of the *Medical Terminology Made Easy* Series of audiotapes available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

4. Anatomy charts and models on the reproductive (male and female) systems are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
   P.O. Box 21207
   Waco, TX 76702-1207
   800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
   3823 Leavenworth Street
   Omaha, NB 68105
   800-228-7117

Reproductive System
Unit 12

Answers to Student Supplements

Student Supplement 1

a. Ovaries
b. Uterine tubes (fallopian tubes, oviducts, salpinx)
c. Uterus
d. Vagina

Student Supplement 2

a. Perineum
b. Vulva
c. Labia minora
d. Labia majora
e. Mons veneris or pubis
f. Clitoris
g. Urinary meatus
h. Vestibule
i. Vaginal orifice

Student Supplement 3

1. b
2. c
3. b
4. c
5. b
6. d
7. a
8. a
9. d
10. b
11. d
12. c
13. b
14. d
15. c
16. b
17. c
18. c
19. d
20. c
21. b
22. c
23. b
24. b
25. b
26. c
27. d
28. d
29. a
30. c

Reproductive System
Unit 12

Answers to Written Test

1.

a.	12	f.	19	k.	3	p.	5
b.	16	g.	8	l.	6	q.	23
c.	10	h.	17	m.	4	r.	15
d.	9	i.	18	n.	20	s.	21
e.	1	j.	2	o.	13	t.	14

2. Any two of the following:

   a. Perpetuation of the human species
   b. Sexual gratification
   c. Secretion of hormones

3. a. Third
   b. Do
   c. Do
   d. Spermatozoa
   e. 45

4. a. Any two of the following:

      (1) Increase in size of larynx causing a lower pitched voice
      (2) Rapid growth of external genitalia
      (3) Growth of hair of the face, pubis, axilla, and other parts of the body
      (4) Development of firmer musculature, broad shoulders, and narrow hips

   b. Any two of the following:

      (1) Development of breasts
      (2) Broadening of the hips
      (3) Growth of hair on the pubis and axilla
      (4) Onset of menstruation

Answers to Written Test

5.
- a. 4
- b. 3
- c. 1
- d. 2
- e. 3
- f. 1
- g. 3
- h. 2
- i. 1
- j. 3

6.
- a. 4
- b. 2
- c. 3
- d. 1
- e. 2
- f. 3
- g. 1
- h. 1
- i. 4

7.
- a. SC
- b. P
- c. S
- d. S
- e. P
- f. S
- g. P
- h. SC

8. a, c, g

9. b, c, d

10.
- a. Ovaries
- b. Uterine tubes
- c. Uterus
- d. Vagina
- e. Labia majora
- f. Labia minora
- g. Clitoris
- h. Urethra meatus
- i. Vestibule
- j. Vaginal orifice

11.
- a. Anterior, posterior
- b. Ligaments
- c. 1 inch
- d. 8 to 10
- e. Larger
- f. Smaller
- g. Triangular

12. b, d, e

13.
- a. Fundus
- b. Body
- c. Cervix

Answers to Written Test

14. a. Sacrum, forward
    b. Backward
    c. Forward
    d. Forward
    e. Cervix
    f. Retroversion
    g. Bending

15. a. M
    b. P
    c. E
    d. P
    e. E
    f. M
    g. P
    h. E

16. a. 3
    b. 1
    c. 5
    d. 2

17. a. Fallopian
    b. Mucosa
    c. Outer
    d. Broad
    e. 4
    f. Fimbriae

18. b, d, f

19. b, d

20. a. Produce, develop, and mature the female gametes (ova) and discharge them into the pelvic cavity
    b. Secrete female hormones, estrogen and progesterone

21. d, e

22. a. Copulation
    b. Birth canal
    c. Menstrual flow

23. a. 7
    b. 4
    c. 6
    d. 11
    e. 3
    f. 9
    g. 1
    h. 10
    i. 5

Answers to Written Test

24. a. Pectoralis
    b. Estrogens
    c. Pregnancy
    d. Areola
    e. Pituitary
    f. Lactiferous

25. a. 3
    b. 2
    c. 5
    d. 4

26. a. Puberty, menopause
    b. Menarche
    c. Blood
    d. 7
    e. 4 to 5
    f. 27 to 28
    g. Hormones
    h. Pregnancy
    i. Emotional or hormonal disturbances

27. a. 2
    b. 4
    c. 1
    d. 5

28. a. Fertilization
    b. Embryo
    c. Placenta
    d. 280
    e. Amniotic
    f. Placental
    g. Cervix

Reproductive System
Unit 12

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

_____a. Branch of medicine which deals with the pelvic diseases and hygiene of women

_____b. Branch of medicine which deals with prenatal care, childbirth, and postpartum care

_____c. Generic terms referring to both female and male sex glands

_____d. A mature male or female reproductive cell

_____e. Secretion from the breast before the onset of true lactation consisting of serum and white blood cells; called "first milk"

_____f. Female sex cell containing 23 chromosomes

_____g. A very small excretory or secretory sac

_____h. A spherical structure in the cortex of the ovary containing the immature ovum and its encasing cells

_____i. The periodic rupture of the graafian follicle and its discharge of the ovum

_____j. Sexual intercourse

_____k. Ejection of the seminal fluids from the male urethra

_____l. Union of the female and male sex cells

1. Colostrum
2. Copulation
3. Ejaculation
4. Embryo
5. Episiotomy
6. Fertilization
7. Fetus
8. Follicle
9. Gamete
10. Gonad
11. Graafian follicle
12. Gynecology
13. Labor
14. Menopause
15. Menstruation
16. Obstetrics
17. Ovarian follicle
18. Ovulation
19. Ovum

Written Test

______m. Stage of development of the human in the uterus after conception between the second and eighth weeks

______n. Condition of carrying a developing embryo/fetus in the uterus

______o. Process by which fetus is expelled from the uterus

______p. Incision of perineum at end of second stage of labor to avoid laceration of perineum and to facilitate delivery

______q. Mature male sex cell containing 23 chromosomes

______r. Periodic (usually monthly) discharge of a bloody fluid from the uterus

______s. Period in life at which one of either sex becomes functionally capable of reproduction

______t. Period in life which marks the permanent cessation of menstruation

20. Pregnancy

21. Puberty

22. Reproductive system

23. Spermatozoon

2. List two functions of the reproductive system.

   a. ____

   b. ____

3. Complete the following statements concerning the development of the human reproductive organs by circling the correct answers.

   a. By the end of the (first, third) month, the sex of the fetus is clearly distinguishable.

   b. At birth, the testes (do, do not) contain thousands of immature spermatocytes.

   c. From birth to the age of puberty, the reproductive organs (do, do not) grow with the rest of the body.

   d. Puberty is indicated in the male by the production of functional (testosterone, spermatozoa) and in the female by the onset of ovulation and menstruation.

   e. The female gonads usually become inactive at about the age of (45, 65).

Written Test

4. List two secondary sex characteristics for both male and female.

   a. Male

      (1) ____________________

      (2) ____________________

   b. Female

      (1) ____________________

      (2) ____________________

5. Match primary and accessory male reproductive glands on the right with the correct descriptions.

______a. Two small, pea-sized glands located on each side of the membranous section of the urethra; one on each side of the prostate gland

______b. Are two small, ovoid glands located in the scrotum suspended from the inguinal region by the spermatic cord

______c. A single globular gland which lies inferior to the bladder outlet and surrounds the first section of the urethra

______d. Two membranous, hollow pouches which lie obliquely between the bladder and rectum, and are posterior to the lower portion of the bladder

______e. Secrete the hormones testosterone and androsterone directly into the blood and therefore are also considered endocrine or ductless glands

______f. Urethra passes through it

______g. Are the male gonads

______h. The anterior portion of these converge with the corresponding vas deferens to form the ejaculatory duct

______i. Most common site for cancer in the male reproductive system

______j. Produce spermatozoa

1. Prostate gland
2. Seminal vesicles
3. Testes
4. Cowper's glands (bulbourethral glands)

Written Test

6. Match seminal ducts on the right with the correct descriptions.

_____a. Terminal portion of the male genitourinary system

_____b. Is a continuation of the epididymis

_____c. Formed by the union of the excretory ducts of the seminal vesicles and the vas deferens

_____d. Very small in diameter, but measures approximately 20 feet in length

_____e. Thick-walled tube about 18 inches long

_____f. Are short tubes which pass through the lobes of the prostate gland where they terminate, and open into the urethra to discharge their contents

_____g. Connects the testes with the vas deferens

_____h. Single, tightly coiled tube which lies along the sides and superior portion of the testes

_____i. Serves as a passageway for eliminating semen and urine

1. Epididymis
2. Vas deferens
3. Ejaculatory ducts
4. Urethra

7. Distinguish between the supporting structures of the male reproductive system by placing the following letters next to the appropriate characteristics: "S" for scrotum, "P" for penis, and "SC" for spermatic cords.

_____a. Contains the vas deferens, testicular artery, veins, lymphatics, and nerve fibers

_____b. Cylindrical, pendulous organ suspended from the front and sides of the pubic arch

_____c. Regulates and maintains favorable temperature for sperm production

_____d. Internally, it is divided into two sacs by a septum which contains the testes

_____e. Is the male copulatory organ by which male gametes are introduced into the female vagina

_____f. Skin-covered pouch suspended from the perineal region

_____g. Contains the urethra

_____h. Passes through the inguinal ring and descends into the scrotum

Written Test

8. Select true statements concerning the seminal fluid by placing an "X" next to the true statements.

______a. Is the fluid which is discharged during the male ejaculation

______b. Is a thin, clear fluid which is the product of the male reproductive glands

______c. Is a combination of sperm and secretions

______d. Is composed of fluid from the following glands: pituitary, testes, adrenal, and prostate

______e. Each 1 cc. of this fluid contains less than 5 thousand sperm.

______f. An average ejaculation contains 3 to 5 cc. which has about 150 to 250 thousand sperm.

______g. Discharge of this fluid is initiated by peristaltic waves moving along the tubes leading from the testes.

9. Select true statements concerning characteristics of the female reproductive system by placing an "X" next to the true statements.

______a. Primary function of the female reproductive system is to secrete estrogen.

______b. The hormones secreted by the female endocrine glands affect the functioning and development of the organs before and after puberty.

______c. When child-bearing years are over, the hormones maintain a balance as the organs no longer function to prepare for pregnancy.

______d. The organs lie deep in the body pelvis for protection.

______e. All female reproductive organs are internal.

Written Test

10. Identify the following female reproductive organs, and place your answers in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

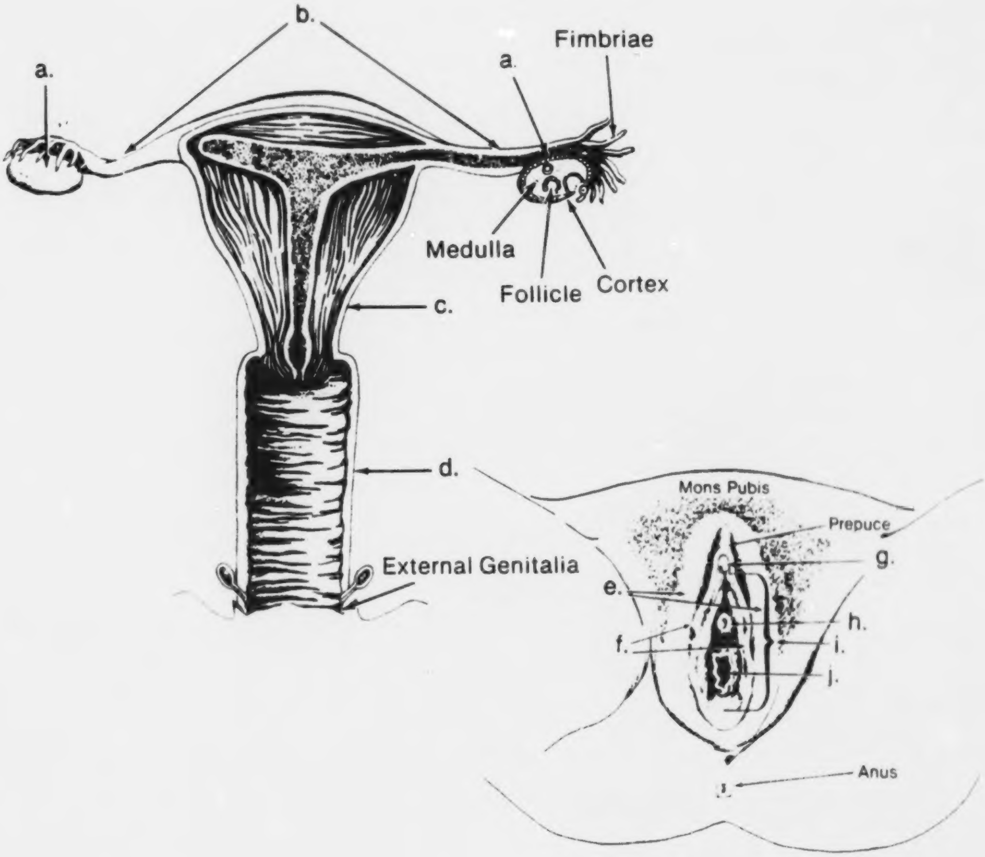
f. ______________________

g. ______________________

h. ______________________

i. ______________________

j. ______________________


b.
a.
a.
Fimbriae
Medulla
Follicle
Cortex
c.
d.
External Genitalia
Mons Pubis
Prepuce
g.
e.
h.
f.
i.
j.
Anus

Written Test

11. Complete the following statements concerning characteristics of the uterus by filling in the blanks with the correct answers.

    a. A hollow, pear-shaped, muscular organ located in the pelvic cavity ________________ to the rectum and ________________ to the urinary bladder

    b. Is not firmly attached to any part of the skeleton; instead is suspended in pelvic cavity by various ________________

    c. Is about 3 inches long, about 2 inches wide at the upper end, and about ________________ thick

    d. Becomes enormously enlarged during pregnancy to 12 inches or more in length extending into the epigastric region and ________________ inches in width

    e. Returns to almost its original size after delivery, but is always slightly ________________ than before pregnancy

    f. After menopause, becomes ________________ and atrophies

    g. The cavity is ________________ in shape and has three openings.

12. Select functions of the uterus by placing an "X" in the appropriate blanks.

    _____a. To produce ovum

    _____b. To contain and nourish the embryo and later fetus from the time the fertilized egg is implanted to the time of the birth of the fetus

    _____c. To act as a passageway for ovaries to urinary tubes

    _____d. To contract its muscles and expel the fetus at end of pregnancy

    _____e. To slough away the endometrium if fertilization does not occur

    _____f. To manufacture estrogen

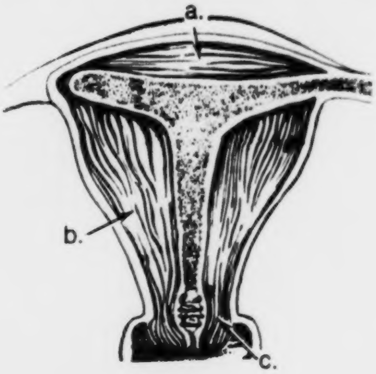
Written Test

13. Identify the parts of the uterus and place your answers in the blanks provided.

    a. ______________________

    b. ______________________

    c. ______________________



14. Complete the following statements concerning the normal and abnormal positioning of the uterus by filling in the blanks with the correct answers.

    a. Normally, the cervix points toward the lower end of the ________________ with the fundus inclined ________________ toward the suprapubic region.

    b. A full bladder tilts the uterus ________________.

    c. A distended rectum tilts the uterus ________________.

    d. Anteversion is an abnormal ________________ tipping of the uterus.

    e. Anteflexion is an abnormal forward bending of the fundus and body at the ________________.

    f. ________________ is an abnormal backward tipping or displacement of the uterus.

    g. Retroflexion is abnormal backward ________________ of the fundus and body at the cervix.

Written Test

15. Distinguish between the layers of the uterine walls by placing the following letters next to the correct characteristics: "E" for endometrium, "M" for myometrium, and "P" for perimetrium.

______a. Is the middle layer

______b. Is the external coat

______c. Is the internal mucous membrane which is continuous with that lining the vagina and the uterine tubes

______d. Is a serous membrane derived from parietal peritoneum

______e. Is the layer that sloughs off during menstruation and following delivery of a fetus

______f. Is a thick coat which contains three layers of smooth muscle fibers

______g. Is incomplete as it covers none of the cervix and only part of the body

______h. Normally is not found anywhere else in the body

16. Match ligaments supporting the uterus on the right with the correct descriptions.

______a. Composed of peritoneum; pass backward from the cervix on either side of the rectum to the posterior wall of the pelvis

______b. A fold of peritoneum that covers and forms the floor of the pelvis in the female; crosses the pelvis from one side to the other, and divides the pelvis into an anterior part containing the urinary bladder and a posterior part containing the rectum

______c. Composed of peritoneum; extends from the posterior surface of the uterus to the rectum

______d. Not composed of peritoneum; two rounded fibro-muscular cords situated between the folds of the broad ligaments attached anteriorly to the wall of the pelvis

1. Broad
2. Round
3. Ureterosacral
4. Anterior
5. Posterior

Written Test

17. Complete the following statements concerning the characteristics of the uterine tubes by circling the correct answers.

    a. Also called (fallopian, bartholin) tubes, salpinx, or oviducts

    b. Are muscular and lined with (mucosa, serosa)

    c. Are attached to the upper, (inner, outer) angle of the uterus opening into the uterus

    d. Pass between the folds and lie along the rim of the (round, broad) ligaments; from here they extend upward and outward toward the sides of the pelvis, then curve downward and backward

    e. Each tube is approximately (4, 10) inches long.

    f. The margin of the distal end is dilated, funnel-shaped, and surrounded by a number of free finger or fringe-like processes called (fimbriae, rugae).

18. Select functions of the uterine tubes by placing an "X" in the appropriate blanks.

    ______a. Produce ovum

    ______b. Provide common place for fertilization

    ______c. Produce progesterone

    ______d. Provide an area where the ovum is nourished and delayed for fertilization

    ______e. Move ovum from ovary to peritoneal cavity

    ______f. Act as passageways for the ova and spermatozoa

19. Select true statements concerning the characteristics of the ovaries by placing an "X" next to the true statements.

    ______a. Resemble large baseballs in size and shape

    ______b. Are located one on either side of the uterus, and are attached to the back of the broad ligament behind and below the uterine tubes

    ______c. Each lies between the folds of the ureterosacral ligament.

    ______d. Are anchored to the uterus by the ovarian ligament

Written Test

20. List the two functions of the ovaries.

a. ______________________________

b. ______________________________

21. Select true statements concerning the characteristics of the vagina by placing an "X" next to the true statements.

______a. Is a broad muscular canal lined with endometrium

______b. Is situated in front of the urethra and urinary bladder

______c. Extends downward and forward from the cervix of the uterus to the fundus

______d. Is a collapsible tube which is the passageway from the uterus to the outside

______e. The posterior wall is about 3 to 4 inches long and the anterior wall is about 2½ to 3 inches long

______f. Has folds of fimbriae

22. Complete the following statements concerning the functions of the vagina by filling in the blanks with the correct answers.

a. Organ of __________________; receives seminal fluid from male

b. Serves as lower part of __________________ and stretches to allow the passage of the fetus

c. Acts as excretory duct for uterine secretions and __________________

Written Test

23. Match external genitalia on the right with the correct descriptions.

______a. The prominent skin-covered fat pad over the symphysis pubis which, after puberty, becomes covered with hair

______b. Portion lying beneath the mons veneris

______c. Two longitudinal folds of skin on each side of the vaginal opening which are covered with pigmented skin and hair on the outer surface, but which is free of hair on the inside mucous lining

______d. Two longitudinal folds of epithelial tissue located within the labia majora which come together anteriorly in the prepuce of the clitoris

______e. At the bottom of the vestibule, posterior to the urinary meatus

______f. Two bean-shaped glands, one on either side of the vaginal orifice, which secrete lubricating fluid for the vulva canal

______g. Two tiny mucous glands which open into the female urethra just at its termination, and secrete lubricating fluid

______h. Region between the vaginal orifice and the anus considered the muscular floor of the pelvis

______i. Erectile, highly sensitive structure partially hidden by the anterior ends of the labia minora

1. Skene's glands
2. Vestibule
3. Vaginal orifice
4. Vulva
5. Clitoris
6. Labia majora
7. Mons veneris or pubis
8. Urinary meatus
9. Bartholin glands
10. Perineum
11. Labia minora

24. Complete the following statements concerning the breasts by circling the correct answers.

a. Lie over the (pectoralis, sartorius) muscles and are attached to them by a layer of connective tissue.

b. (Estrogens, Progesterones) cause the initial growth of the breasts.

c. They become functional at end of (pregnancy, puberty).

Written Test

d. The nipples are bordered by a circular, pigmented area called the (areola, alveoli).

e. (Pituitary, Thyroid) hormones stimulate the production of colostrum and milk.

f. The (sebaceous, lactiferous) glands secrete the colostrum and milk.

25. Match the phases of the menstrual cycle on the right with the correct characteristics.

______a. Endometrium continues to thicken in preparation for the ovum if it is fertilized; corpus luteum begins to develop in ruptured follicle and secretes progesterone

______b. Endometrium continues to grow; graafian follicle ruptures and liberates ovum; average occurrence is on the 14th day

______c. Endometrium is repaired and thickens; follicle continues to develop and secretes estrogen

______d. Period of uterine bleeding accompanied by shedding of the endometrium; follicle begins to develop in ovary; averages 4 to 5 days in length

1. Premenstrual or ischemic phase
2. Ovulation
3. Luteal phase
4. Menstrual phase
5. Follicular phase

26. Complete the following statements concerning characteristics of menstruation by filling in the blanks with the correct answers.

a. Occurs from age of ________________ to ________________

b. Onset of menstruation at puberty is referred to as ________________.

c. Menstrual discharge or flow contains endometrial tissue, ________________, and serous fluid.

d. Length varies from 3 to ________________ days.

e. Average length is ________________ days.

f. Occurs on an average every ________________ days

g. Is brought on by the reduction of ovarian ________________ when the ovum is not fertilized

Written Test

h. Ceases temporarily during ________________

i. Failure to occur may result from :

(1) ________________

(2) Physical disorders such as disease or malnutrition

(3) Congenital disorders

27. Match menstrual irregularities on the right with the correct descriptions.

_____a. Absence of flow when normally expected

_____b. Scanty flow

_____c. Painful menstruation

_____d. Excessive flow (and loss of blood) during menstruation

1. Dysmenorrhea
2. Amenorrhea
3. Metrorrhagia
4. Oligomenorrhea
5. Menorrhagia

28. Complete the following statements concerning the characteristics of pregnancy by circling the correct answers.

a. Pregnancy begins with (copulation, fertilization) of the ovum.

b. As soon as the sperm enters the ovum, cellular changes take place and the (fetus, embryo) begins to form.

c. Umbilical cord is formed and extends from the (uterus, placenta) to the fetus.

d. It takes about (280, 350) days for the fetus to develop before it is born.

e. The fetus floats in a bag of (amniotic, seminal) fluid.

f. The mother's body performs the function of waste elimination and acquiring cell food for the growth of the fetus by osmosis through the (placental, uterine) membranes.

g. The fetus is delivered when the (fundus, cervix) of the uterus dilates and flattens enough for the fetus to be pushed into the vaginal canal by the muscles in the fundus, body, and vagina.

***Permission to duplicate this test is granted.**

Reproductive System
Unit 12

Unit Evaluation Form

Student Name ________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

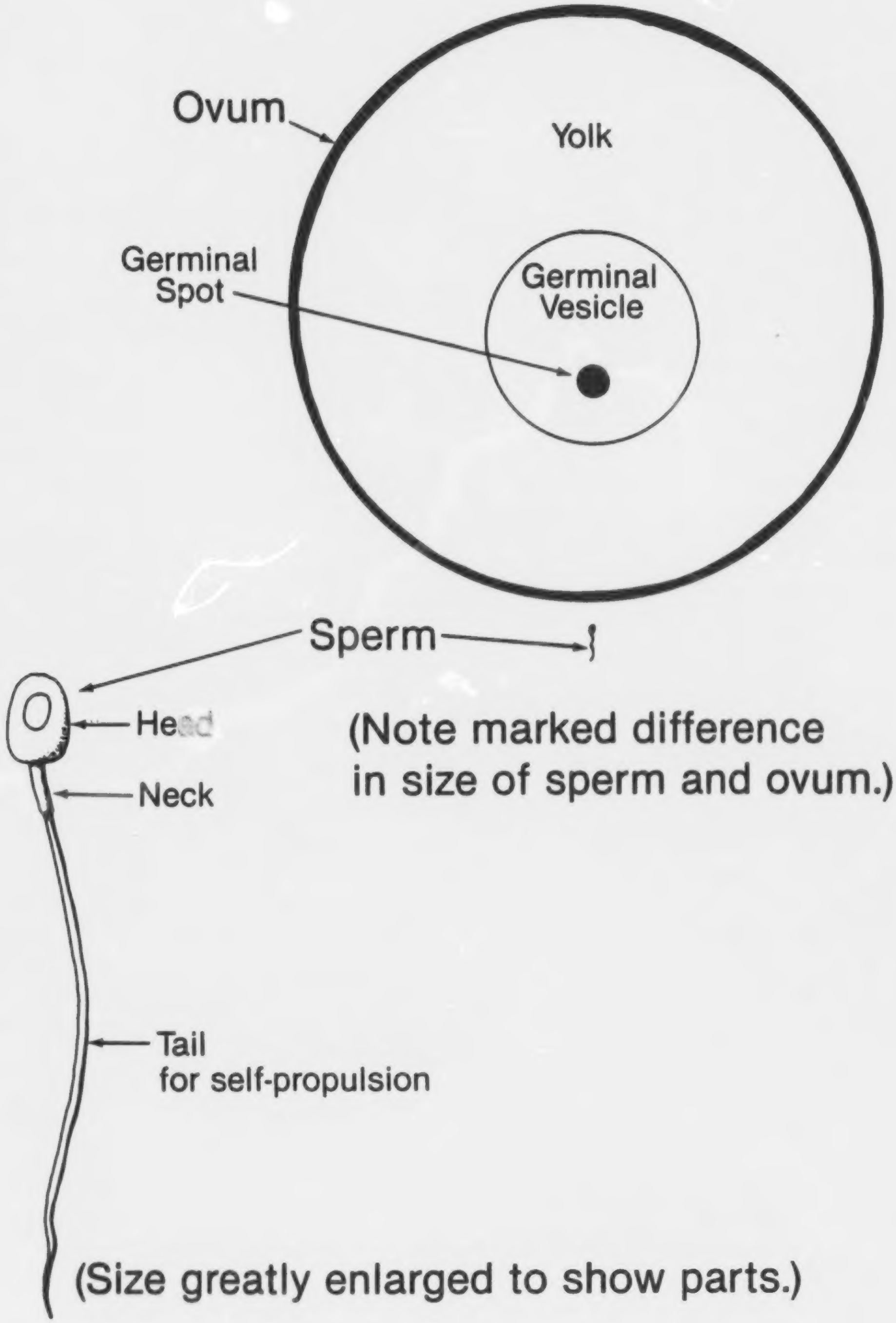
____

Teacher Signature ________________________ Date __________

Student Signature ________________________ Date __________

***Permission to duplicate this form is granted.**

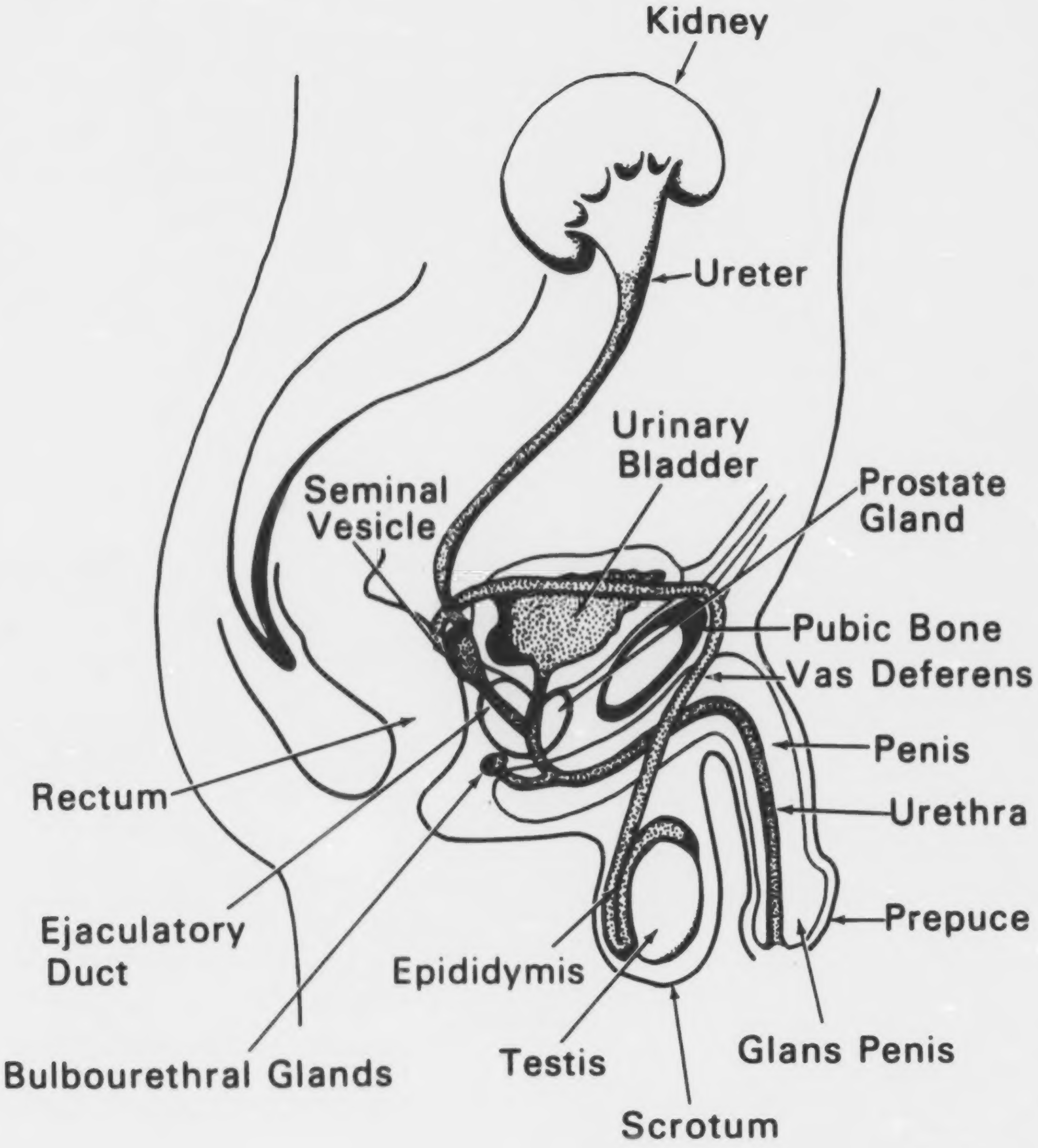
Ovum and Sperm


Ovum
Yolk
Germinal Spot
Germinal Vesicle
Sperm
Head
Neck
Tail
for self-propulsion

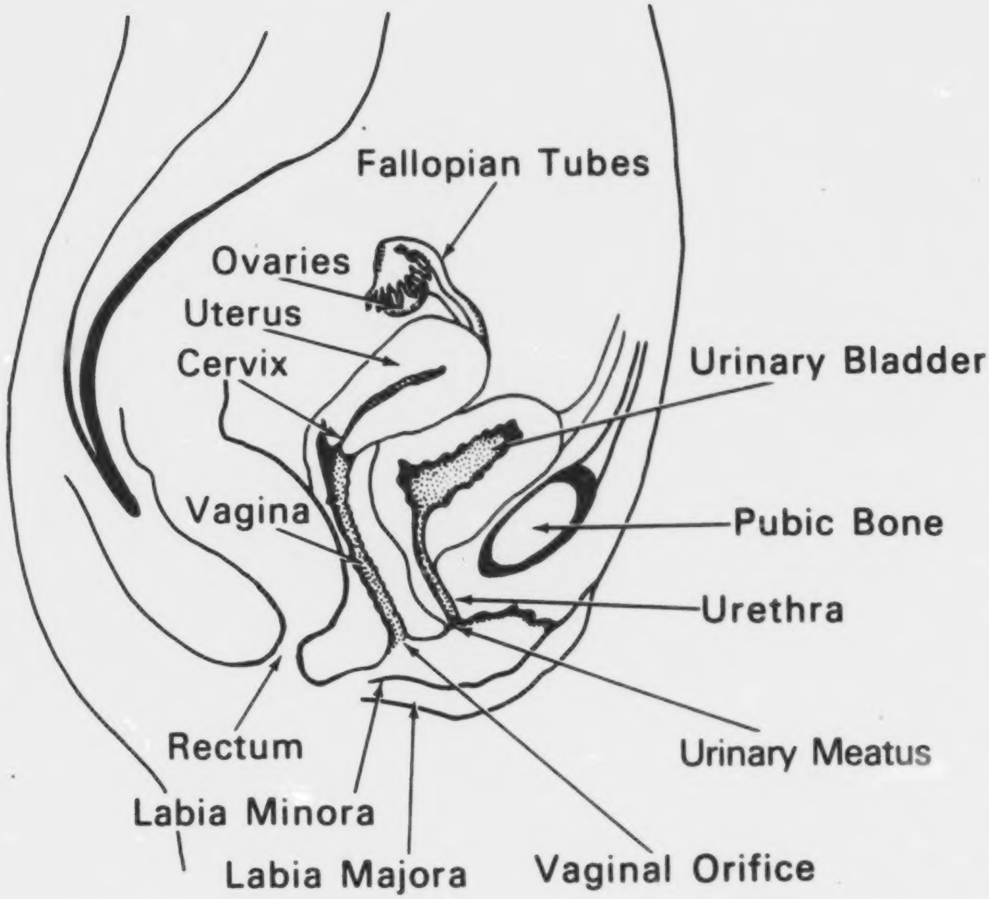
(Note marked difference in size of sperm and ovum.)

(Size greatly enlarged to show parts.)

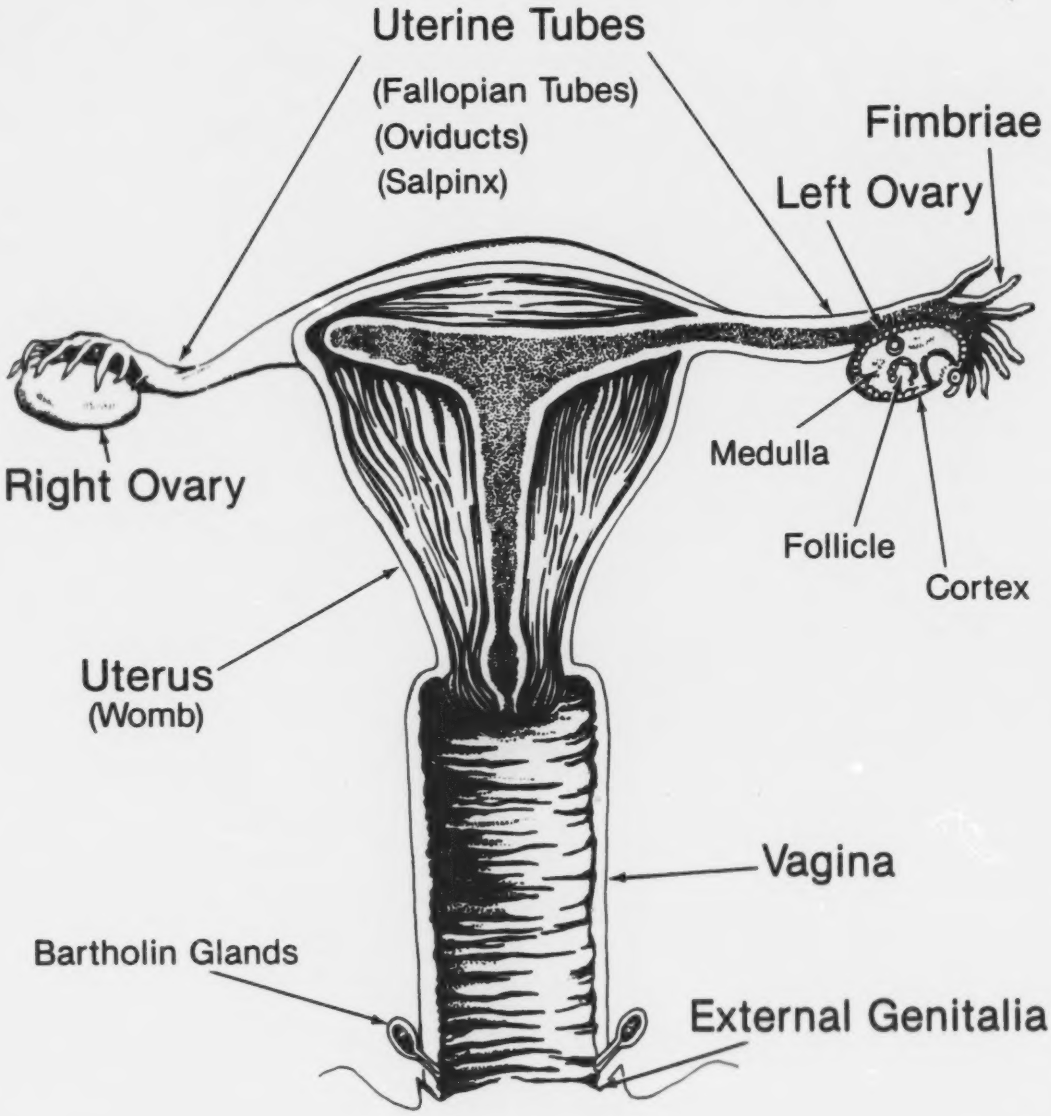
Male Reproductive System


Kidney
Ureter
Urinary Bladder
Seminal Vesicle
Prostate Gland
Pubic Bone
Vas Deferens
Penis
Rectum
Urethra
Prepuce
Ejaculatory Duct
Epididymis
Glans Penis
Testis
Bulbourethral Glands
Scrotum

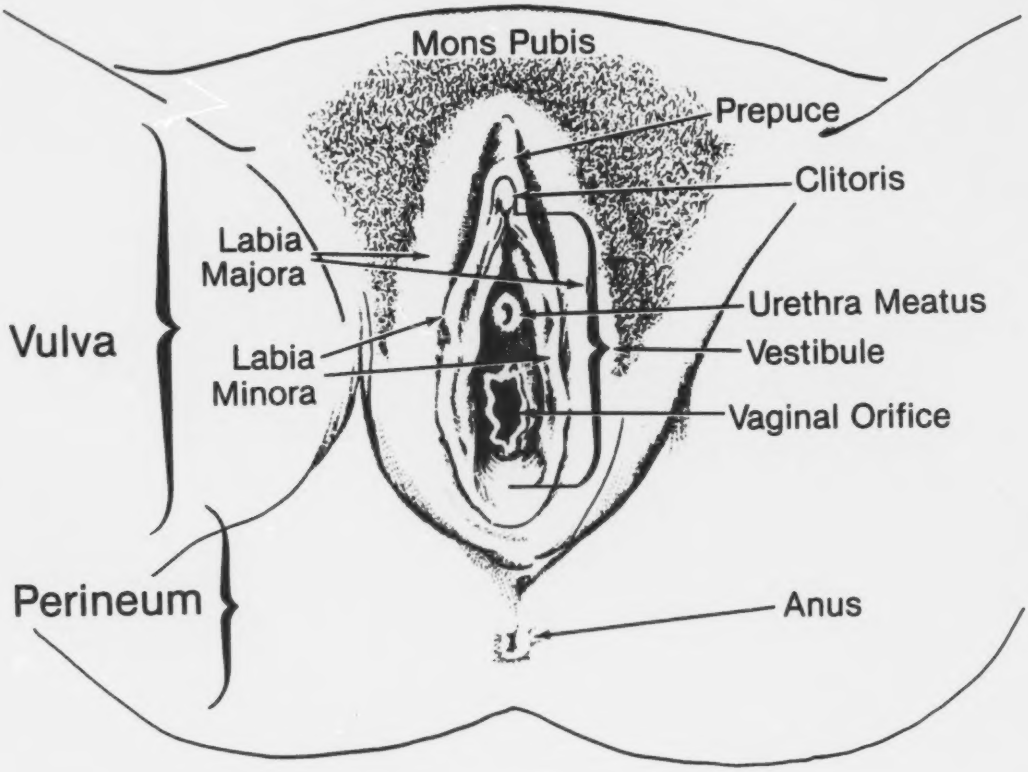
Female Reproductive System


Fallopian Tubes
Ovaries
Uterus
Cervix
Urinary Bladder
Vagina
Pubic Bone
Urethra
Rectum
Urinary Meatus
Labia Minora
Labia Majora
Vaginal Orifice

Internal Female Genitalia

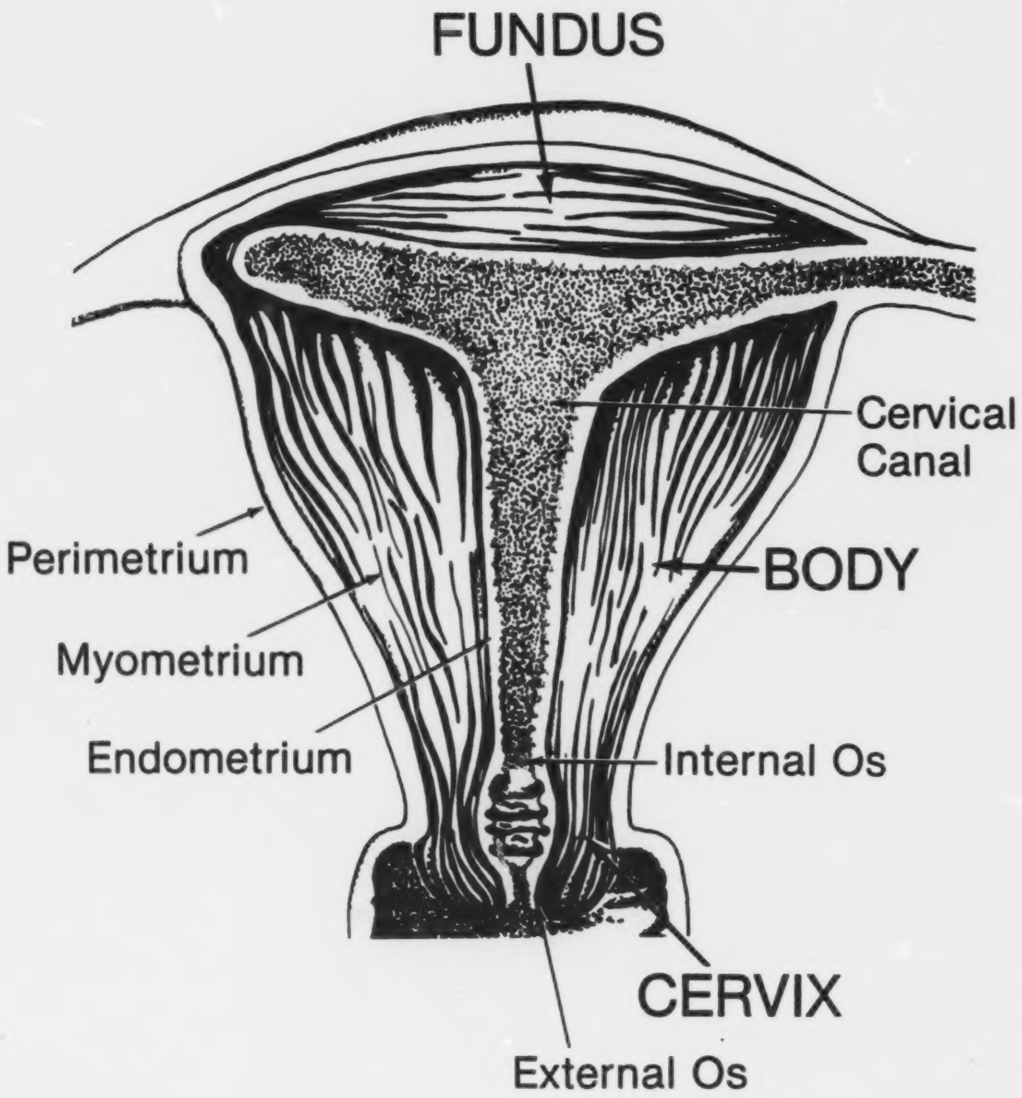

Uterine Tubes
(Fallopian Tubes)
(Oviducts)
(Salpinx)
Fimbriae
Left Ovary
Right Ovary
Medulla
Follicle
Cortex
Uterus
(Womb)
Vagina
Bartholin Glands
External Genitalia

External Female Genitalia

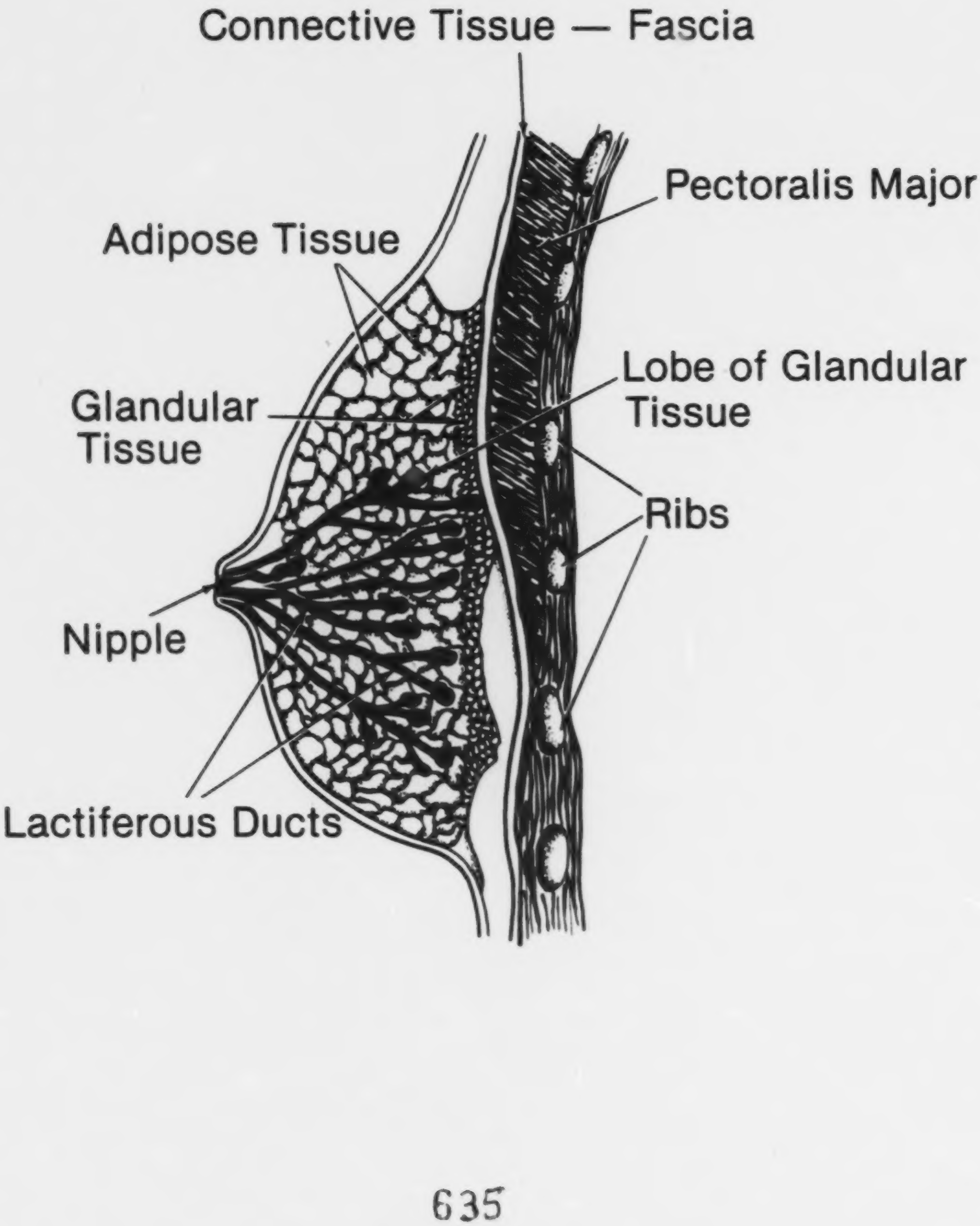

Mons Pubis
Prepuce
Clitoris
Labia Majora
Urethra Meatus
Vulva
Vestibule
Labia Minora
Vaginal Orifice
Perineum
Anus

633

The Uterus

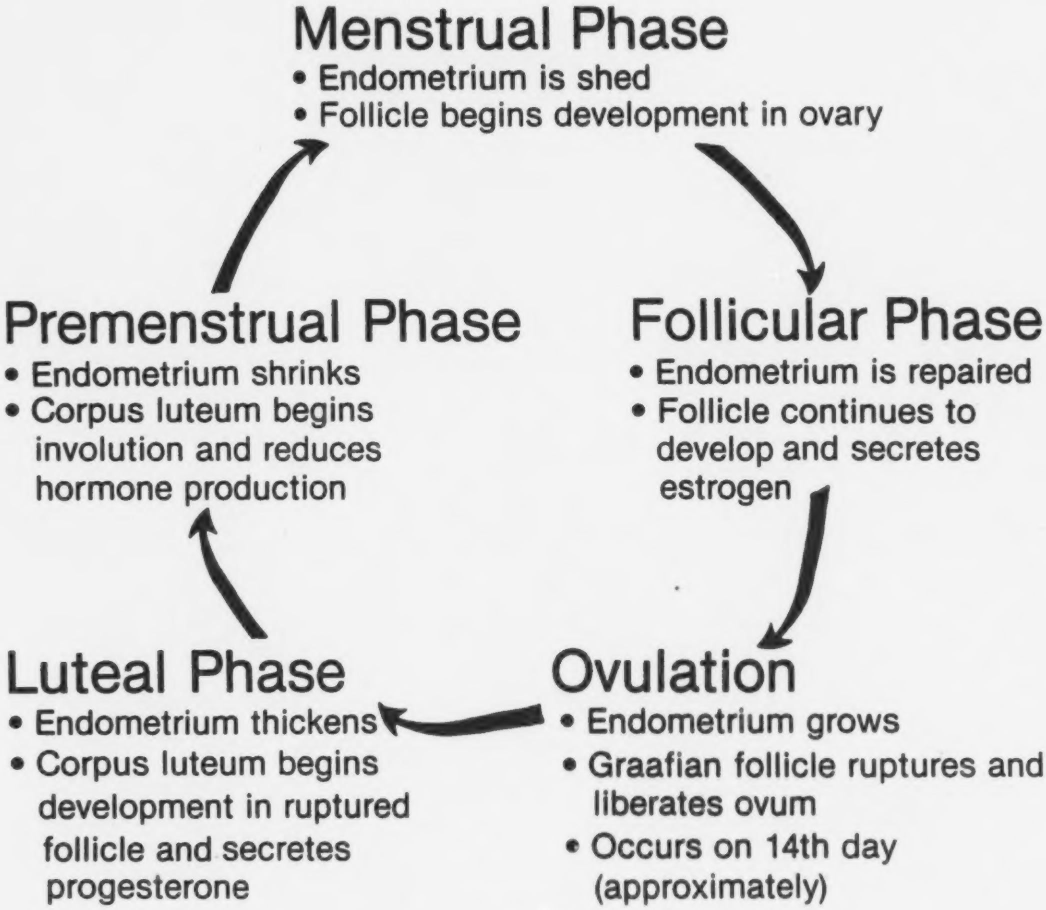

FUNDUS
Cervical Canal
Perimetrium
BODY
Myometrium
Endometrium
Internal Os
CERVIX
External Os

The Breast


Connective Tissue — Fascia
Pectoralis Major
Adipose Tissue
Lobe of Glandular Tissue
Glandular Tissue
Ribs
Nipple
Lactiferous Ducts

635

The Menstrual Cycle



Menstrual Phase

- Endometrium is shed
- Follicle begins development in ovary

Follicular Phase

- Endometrium is repaired
- Follicle continues to develop and secretes estrogen

Ovulation

- Endometrium grows
- Graafian follicle ruptures and liberates ovum
- Occurs on 14th day (approximately)

Luteal Phase

- Endometrium thickens
- Corpus luteum begins development in ruptured follicle and secretes progesterone

Premenstrual Phase

- Endometrium shrinks
- Corpus luteum begins involution and reduces hormone production

Reproductive System
Unit 12

Information Sheet

1. **Terms and definitions**

   a. **Colostrum** — Secretion from the breast before the onset of true lactation consisting of serum and white blood cells; called "first milk"

   b. **Copulation** (coitus) — Sexual intercourse

   c. **Ejaculation** — Ejection of the seminal fluids from the male urethra

   d. **Embryo** — Stage of development of the human in the uterus after conception between the second and eighth weeks

   e. **Episiotomy** — Incision of perineum at end of second stage of labor to avoid laceration of perineum and to facilitate delivery

   f. **Fertilization** (conception) — Union of the female and male sex cells

   g. **Fetus** — Stage of development of the human in the uterus from the third month to birth

   h. **Follicle** — A very small excretory or secretory sac

   i. **Gamete** — A mature male or female reproductive cell

   j. **Gonad** — Generic term referring to both female and male sex glands

   k. **Graafian follicle** — A spherical structure in the cortex of the ovary containing the fully developed ovum

   l. **Gynecology** — Branch of medicine which deals with the pelvic diseases and hygiene of women

   m. **Labor** — Process by which fetus is expelled from the uterus

   n. **Menopause** — Period in life which marks the permanent cessation of menstruation

   o. **Menstruation** — Periodic (usually monthly) discharge of a bloody fluid from the uterus

   p. **Obstetrics** — Branch of medicine which deals with prenatal care, childbirth, and postpartum care

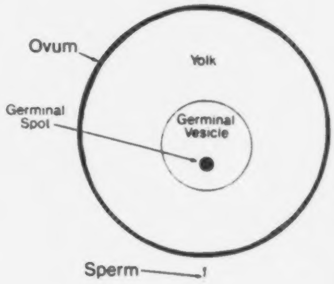
Information Sheet

q. **Ovarian follicle** — A spherical structure in the cortex of the ovary containing the immature ovum and its encasing cells

r. **Ovulation** — The periodic (normally monthly) rupture of the graafian follicle and its discharge of the ovum

s. **Ovum** (pl. ova) — Female sex cell containing 23 chromosomes

Figure 1


Ovum
Yolk
Germinal Spot
Germinal Vesicle
Sperm

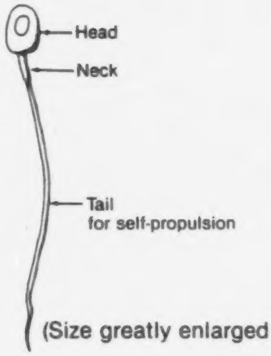
t. **Pregnancy** — Condition of carrying a developing embryo/fetus in the uterus

u. **Puberty** — Period in life at which one of either sex becomes functionally capable of reproduction

v. **Reproductive system** — System of the body involved in the creation of offspring

w. **Spermatozoon** (p. -zoa) — Mature male sex cell containing 23 chromosomes

Figure 2


Head
Neck
Tail
for self-propulsion

(Size greatly enlarged to show parts.)

Information Sheet

2. **Functions of the reproductive system**
   - a. Perpetuation of the human species
   - b. Sexual gratification
   - c. Secretion of hormones

3. **Development of human reproductive organs**
   - a. Development before birth
     - (1) For approximately the first 2 months of embryonic life, no structural differentiation into sexes is evident.
     - (2) By the end of the third month, the sex of the fetus is clearly distinguishable.
   - b. Development after birth
     - (1) Pre-pubescence
       - (a) At birth, the testes contain thousands of immature spermatocytes and the ovaries contain thousands of primitive germ cells.
       - (b) From birth to the age of puberty, the reproductive organs grow with the rest of the body, but are non-functional.
     - (2) Puberty
       - (a) Is indicated in the male by the production of functional spermatozoa and in the female by the onset of ovulation and menstruation
       - (b) Is also marked by the gradual appearance of both physical and mental changes
       - (c) Physical changes are referred to as secondary sex characteristics.
     - (3) Post-pubescence
       - (a) Changes that begin at puberty are not accomplished all at once, but extend over a long period of time. The years during which they are taking place are known as the period of adolescence.
       - (b) The reproductive organs continue to function for many years. The length of time varies between individuals and sexes.
       - (c) The female gonads usually become inactive (no longer produce gametes) at about the age of 45.

         Note: This can vary several years in either direction with different individuals.
       - (d) The male gonads usually function until much later in life, or even throughout life in many cases.

Information Sheet

4. Secondary sex characteristics

a. In the male

  (1) Increase in size of larynx causing a lower pitched voice

  (2) Rapid growth of external genitalia

  (3) Growth of hair of the face, pubis, axilla, and other parts of the body

  (4) Development of firmer musculature, broad shoulders, and narrow hips

b. In the female

  (1) Development of breasts

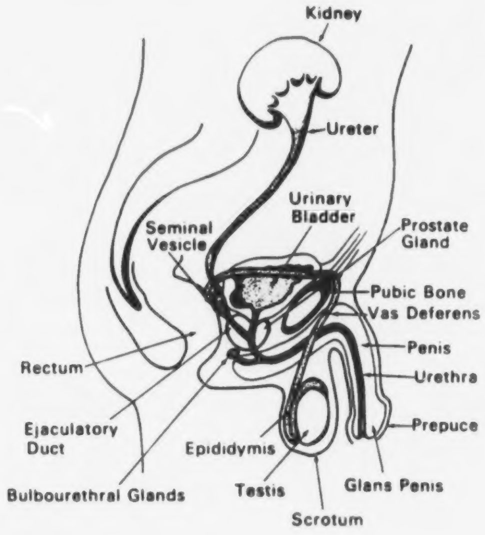
  (2) Broadening of the hips

  (3) Growth of hair on the pubis and axilla

  (4) Onset of menstruation

5. Male reproductive glands

Figure 3


Kidney
Ureter
Urinary Bladder
Seminal Vesicle
Prostate Gland
Pubic Bone
Vas Deferens
Penis
Urethra
Rectum
Prepuce
Ejaculatory Duct
Epididymis
Glans Penis
Testis
Bulbourethral Glands
Scrotum

Information Sheet

a. Primary reproductive glands — Testes (2)

Note: The singular form for testes is testis.

  (1) Are two small, ovoid glands located in the scrotum suspended from the inguinal region by the spermatic cord

  (2) Are the male gonads

  (3) Produce spermatozoa

  (4) Secrete main part of the male reproductive fluid called semen or seminal fluid

  (5) Secrete the hormones testosterone and androsterone directly into the blood and therefore are also considered endocrine or ductless glands

b. Accessory reproductive glands

  (1) Seminal vesicles (2)

    (a) Two membranous, hollow pouches which lie obliquely between the bladder and rectum, and are posterior to the lower portion of the bladder
    (b) Produce secretions which bathe, protect, and provide nutrients for the spermatozoa
    (c) The anterior portion of these converge with the corresponding vas deferens to form the ejaculatory duct.

  (2) Prostate gland (1)

    (a) A single globular gland which lies inferior to the bladder outlet and surrounds the first section of the urethra

    Note: The prostate forms the internal sphincter.

    (b) Urethra passes through the prostate.
    (c) Is composed of glandular tissue and is covered by a fibrous capsule
    (d) Secretes a portion of the semen
    (e) Secretes an alkaline fluid which increases the motility and fertility of the spermatozoa
    (f) Most common site for cancer in the male reproductive system
    (g) An enlargement (hypertrophy) of the prostate gland may squeeze the urethra and close it so completely that urination becomes difficult or impossible. This condition is called BPH, benign prostatic hypertrophy, and is treated by a prostatectomy.

Information Sheet

(3) Cowper's glands (bulbourethral glands) (2)

  (a) Two small, pea-sized glands located on each side of the membranous section of the urethra; one on each side of the prostate gland
  (b) A duct about one inch long connects them with the membranous portion of the urethra.
  (c) Produce an alkaline fluid which adds lubricating and protective mucus to semen

  Note: Alkaline fluid is important in that it counteracts the acid present in the male urethra and the female vagina.

6. **Seminal ducts**

a. Epididymis

(1) Single, tightly coiled tube which lies along the sides and superior portion of the testes

(2) Very small in diameter, but measures approximately 20 feet in length

(3) Ends in the vas deferens

(4) Connects the testes with the vas deferens

(5) Serves as one of the ducts through which sperm pass in their journey from the testes to the exterior

(6) Stores sperm while maturing prior to ejaculation

(7) Secretes part of seminal fluid

b. Vas deferens

(1) Thick-walled tube about 18 inches long

(2) Is a continuation of the epididymis

  (a) Passes through the inguinal canal where it is enclosed in a fibrous cylinder, the spermatic cord, into the abdominal cavity
  (b) Here it extends over the top and down the posterior surface of the urinary bladder where it reaches the prostate gland.

(3) Ends by joining the duct from the corresponding seminal vesicle to form the ejaculatory duct

(4) Serves as a passageway for sperm

Information Sheet

c. Ejaculatory ducts (2)

(1) Formed by the union of the excretory ducts of the seminal vesicles and the vas deferens

(2) One on each side of the midline

(3) Are short tubes which pass through the lobes of the prostate gland where they terminate and open into the urethra to discharge their contents

(4) Serve as passageways for sperm

d. Urethra

(1) Terminal portion of the male genitourinary system

(2) Serves as a passageway for eliminating

(a) Semen and sperm from genital tract
(b) Urine from urinary tract

(3) Divided into three sections for locational purposes:

(a) Prostatic urethra — Passes through the prostate gland from the base of the bladder to the beginning of the membranous urethra
(b) Membranous urethra — Passes from base of the prostate gland through the pelvic wall
(c) Cavernous urethra — Passes from the pelvic wall through the penis

(4) At the terminal end of the penis is the opening of the urethra to the outside, known as the external urethral meatus

7. Supporting structures of the male reproductive system

a. Scrotum

(1) Skin-covered pouch suspended from the perineal region

(2) Internally, it is divided into two sacs by a septum which contains the testes.

(3) The tissues of the scrotum are continuous with those of the groin and perineum.

(4) Protects the testes

(5) Regulates and maintains favorable temperature for sperm production

Information Sheet

b. Penis

(1) Cylindrical, pendulous organ suspended from the front and sides of the pubic arch

(2) Contains the urethra

(3) Is the male copulatory organ by which male gametes are introduced into the female vagina

(4) Is composed of three cylindrical masses of cavernous tissue bound together by fibrous tissue and covered with skin

(a) Two of the masses are lateral and are known as the corpora cavernosa penis.
(b) The third is median and is termed the corpus cavernosum urethra because it contains the urethra.

(5) The term cavernous tissue is used because the relatively large size of the venous spaces which exist in this tissue. It is also described as erectile tissue because the venous spaces may become distended with blood, thus enlarging the tissue, increasing its size, and causing an erection of the penis.

(6) The skin covering the penis is continuous with that covering the pubis, scrotum, and perineum.

(7) At the distal end of the penis, there is a slightly enlarged bulging structure called the glans penis which contains sensory nerve endings and the urinary meatus.

(8) A loose-fitting double fold of skin over the glans penis is known as the prepuce or foreskin.

c. Spermatic cords (2)

(1) Each cord contains the vas deferens, testicular artery, veins, lymphatics, and nerve fibers.

(2) The two cords are formed by these structures where they come together just above the inguinal ring.

(3) The cord passes through the inguinal ring and descends into the scrotum.

(4) In the scrotum each spermatic cord connects with the posterior surface of the testis.

Information Sheet

8. Seminal fluid (semen)

a. Is the fluid which is discharged during the male ejaculation

b. Is a sticky, white, thick fluid which is the product of the male reproductive glands

c. Is a combination of sperm and secretions

d. Is composed of fluid from the following glands:

   (1) Testes

   (2) Epididymis

   (3) Seminal vesicles

   (4) Prostate gland

   (5) Cowper's glands

e. Each 1 cc. of this fluid contains as many as 70 million sperm.

f. An average ejaculation contains 3 to 5 cc. which has about 250 to 350 million sperm.

   Note: Although only one sperm is needed to fertilize an ovum, millions of sperm per cc. seem to be necessary for fertilization to occur. When the sperm count falls below a certain minimum level, sterility results. Semen with 10 to 20 million sperm per cc. is not likely to cause pregnancy.

g. Discharge of this fluid is initiated by peristaltic waves moving along the tubes leading from the testes.

9. Characteristics of the female reproductive system

a. Primary function of the female reproductive system is to prepare the body for pregnancy, contain and support the fetus as it is formed in the mother's body, and to return the organs to normal after birth.

b. The hormones secreted by the female endocrine glands affect the functioning and development of the organs before and after puberty.

c. When child-bearing years are over, the hormones maintain a balance as the organs no longer function to prepare for pregnancy.

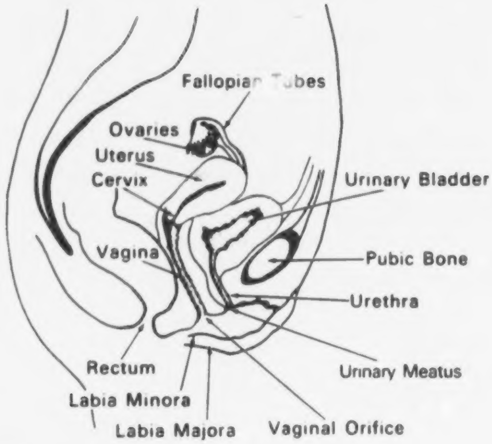
d. The organs lie deep in the body pelvis for protection. As the fetus begins to develop, it must be protected from injury and the mother's body must be able to carry the additional weight.

e. Female reproductive organs are both internal and external.

Information Sheet

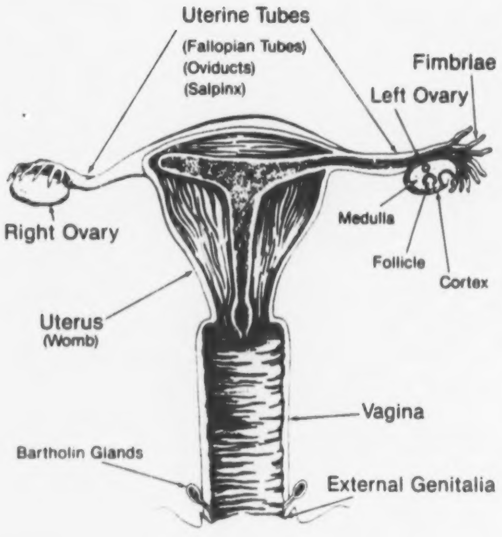
10. Female reproductive organs

Figure 4


Fallopian Tubes
Ovaries
Uterus
Cervix
Urinary Bladder
Vagina
Pubic Bone
Urethra
Rectum
Urinary Meatus
Labia Minora
Labia Majora
Vaginal Orifice

a. Internal genitalia

Figure 5


Uterine Tubes
(Fallopian Tubes)
(Oviducts)
(Salpinx)
Fimbriae
Left Ovary
Right Ovary
Medulla
Follicle
Cortex
Uterus
(Womb)
Vagina
Bartholin Glands
External Genitalia

(1) Ovaries (2)

(2) Uterine tubes (2)

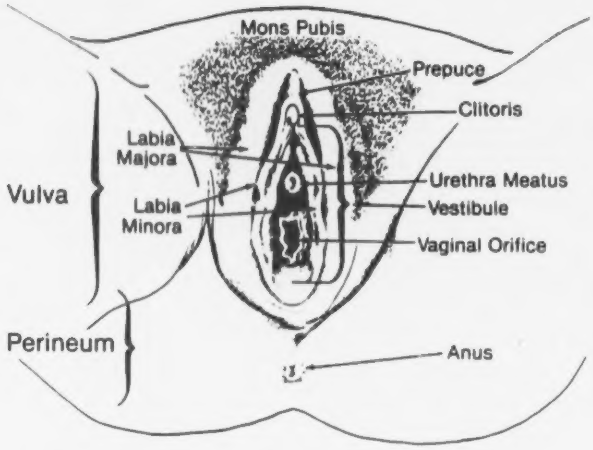
(3) Uterus

(4) Vagina

Information Sheet

b. External genitalia

Figure 6


Mons Pubis
Prepuce
Clitoris
Labia Majora
Urethra Meatus
Vulva
Labia Minora
Vestibule
Vaginal Orifice
Perineum
Anus

(1) Mons veneris or pubis

(2) Vulva

(a) Labia majora
(b) Labia minora
(c) Clitoris
(d) Vestibule

1) Urethra meatus
2) Vaginal orifice
3) Bartholin gland openings (2)

(3) Perineum

11. Characteristics of the uterus (womb)

a. A hollow, pear-shaped, muscular organ located in the pelvic cavity anterior to the rectum and posterior to the urinary bladder

b. Is not firmly attached to any part of the skeleton; instead is suspended in pelvic cavity by various ligaments

c. Is about 3 inches long, about 2 inches wide at the upper end, and about 1 inch thick

d. Becomes enormously enlarged during pregnancy to 12 inches or more in length extending into the epigastric region and 8 to 10 inches in width

Information Sheet

e. Returns to almost its original size after delivery, but is always slightly larger than before pregnancy

f. After menopause, becomes smaller and atrophies

g. The uterine cavity is small because of the thickness of the muscular walls.

h. The cavity is triangular in shape and has three openings:

  (1) One at each upper end or angle communicating with the uterine tubes

  (2) One at the internal orifice opening into the cervix below

i. Receives blood supply from uterine and ovarian arteries

12. Functions of the uterus

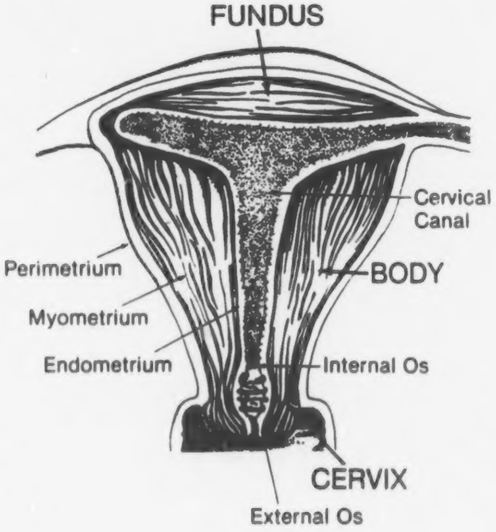
a. To contain and nourish the embryo and later fetus from the time the fertilized egg is implanted to the time of the birth of the fetus (pregnancy)

b. To contract its muscles and expel the fetus at end of pregnancy (labor)

c. To slough away the endometrium if fertilization does not occur (menstruation)

13. Parts of the uterus

Figure 7


FUNDUS
Cervical Canal
Perimetrium
BODY
Myometrium
Endometrium
Internal Os
CERVIX
External Os

Information Sheet

a. **Fundus** — The convex, rounded, superior portion located above the level at which the uterine tubes enter the uterus on the anterior portion

Note: This is about 3 inches long and 3 inches wide at its widest portion.

b. **Body** — The portion between the fundus and the cervix

c. **Cervix or neck** — The lower constricted part that extends from the body of the uterus into the vaginal canal

Note: This part must dilate during labor for delivery of the fetus.

(1) The cervix is constricted above, where it opens into the body of the uterus, by means of the internal os.

(2) The cervix is constricted below, where it opens into the vagina, by means of the external os.

Note: Between the internal and external os the cervical canal is somewhat enlarged.

14. **Normal and abnormal positioning of the uterus**

a. Normally, the cervix points toward the lower end of the sacrum with the fundus inclined forward toward the suprapubic region.

b. Position is altered by gravity or change of position.

c. A full bladder tilts the uterus backward.

d. A distended rectum tilts the uterus forward.

e. Anteversion is an abnormal forward tipping of the uterus.

f. Anteflexion is an abnormal forward bending of the fundus and body at the cervix.

Note: The cervix is not necessarily misplaced, just the body and fundus.

g. Retroversion is an abnormal backward tipping or displacement of the uterus.

h. Retroflexion is abnormal backward bending of the fundus and body at the cervix.

Note: As in anteflexion, the cervix's position usually remains unchanged.

Information Sheet

15. Layers of the uterine walls

a. Endometrium

(1) Is the internal mucous membrane which is continuous with that lining the vagina and the uterine tubes

(2) Is highly vascular and spongy, and is provided with numerous uterine glands

(3) Normally is not found anywhere else in the body

(4) Is the layer that sloughs off during menstruation and following delivery of a fetus

Note: The endometrial layers do not slough off if conception has taken place.

b. Myometrium

(1) Is the middle layer

(2) Is a thick coat which contains three layers of smooth muscle fibers

(3) Is thickest in the fundus and thinnest in the cervix

c. Perimetrium

(1) Is the external coat

(2) Is a serous membrane derived from parietal peritoneum

(3) Is incomplete as it covers none of the cervix and only part of the body

16. Ligaments supporting the uterus

Note: These ligaments are attached to the lateral walls of the pelvis.

a. Broad (2)

(1) A fold of peritoneum that covers and forms the floor of the pelvis in the female

(2) Crosses the pelvis from one side to the other, and divides the pelvis into an anterior part containing the urinary bladder and a posterior part containing the rectum

Information Sheet

b. Uterosacral (2)

   (1) Composed of peritoneum

   (2) Pass backward from the cervix on either side of the rectum to the posterior wall of the pelvis

c. Round (2)

   (1) Not composed of peritoneum

   (2) Two rounded fibro-muscular cords situated between the folds of the broad ligaments attached anteriorly to the wall of the pelvis

d. Posterior ligament (1)

   (1) Composed of peritoneum

   (2) Extends from the posterior surface of the uterus to the rectum

   Note: This forms a deep pouch known as the "Cul-de-sac of Douglas" between the uterus and rectum.

e. Anterior ligament (1)

   (1) Composed of peritoneum

   (2) Extends from anterior surface of uterus to the bladder

17. Characteristics of uterine tubes (2)

a. Are also called fallopian tubes, salpinx, or oviducts

b. Are muscular and lined with mucosa

c. Are attached to the upper, outer angle of the uterus opening into the uterus

d. Pass between the folds and lie along the rim of the broad ligaments; from here they extend upward and outward toward the sides of the pelvis, then curve downward and backward

e. Each tube is approximately 4 inches long.

f. At the point of attachment to the uterus, they are very narrow, but gradually increase in size so that the distal end is larger.

g. The margin of the distal end is dilated, funnel-shaped, and surrounded by a number of free finger or fringe-like processes called fimbriae.

Information Sheet

18. **Functions of the uterine tubes**

    a. Act as passageways for the ova and spermatozoa

    b. Provide an area where the ovum is nourished and delayed for fertilization

    c. Provide common place for fertilization

    d. Move ovum from ovary to uterus

    Note: The uterine tubes serve as ducts to convey the ova from the ovaries to the uterus, although they are not actually considered connected to the ovaries. It is thought that the movement of the cilia on the fimbriae and in the tubes produces a current which draws the ovum into the tube. After the ovum enters the tube, it is carried to the uterus by the peristaltic action of the tube and the movement of the cilia.

19. **Characteristics of the ovaries (2)**

    a. Resemble large almonds in size and shape

    b. Are located one on either side of the uterus, and are attached to the back of the broad ligament behind and below the uterine tubes

    c. Each lies between the folds of the broad ligament

    d. Are anchored to the uterus by the ovarian ligament

20. **Functions of the ovaries**

    a. Produce, develop, and mature the female gametes (ova) and discharge them into the pelvic cavity

    b. Secrete the female hormones estrogen and progesterone

    Note: The ovaries are considered both part of the endocrine system since they secrete hormones and part of the female reproductive system since they produce the female gametes.

21. **Characteristics of the vagina**

    a. Is a broad, muscular canal lined with mucous membrane

    b. Is situated in front of the rectum and behind the urethra and urinary bladder

    c. Extends downward and forward from the cervix of the uterus to the vulva

    d. Is a collapsible tube which is the passageway from the uterus to the outside

    e. The posterior wall is about 3 to 4 inches long, and the anterior wall is about $2\frac{1}{2}$ to 3 inches long.

    f. Has folds of rugae

Information Sheet

22. **Functions of the vagina**

    a. Organ of copulation; receives seminal fluid from male

    b. Serves as lower part of birth canal and stretches to allow the passage of the fetus

    c. Acts as excretory duct for uterine secretions and menstrual flow

23. **Female external genitalia**

    a. **Mons veneris or pubis** — The prominent skin-covered fat pad over the symphysis pubis which, after puberty, becomes covered with hair

    b. **Vulva** — Portion lying beneath the mons veneris; consists of the following:

        (1) Labia majora (large lips) — Two longitudinal folds of skin on each side of the vaginal opening which are covered with pigmented skin and hair on the outer surface, but which are free of hair on the inside mucous lining

        (2) Labia minora (small lips) — Two longitudinal folds of epithelial tissue located within the labia majora which come together anteriorly in the prepuce of the clitoris

        (3) Clitoris — Erectile, highly sensitive structure partially hidden by the anterior ends of the labia minora

        (4) Vestibule — Almond-shaped space between the lines of attachment of the labia minora; contains the following:

            (a) Urinary meatus — Small opening of the urethra
            (b) Vaginal orifice — At the bottom of the vestibule, posterior to the urinary meatus
            (c) Bartholin glands — Two bean-shaped glands, one on either side of the vaginal orifice, which secrete lubricating fluid for the vulva canal
            (d) Skene's glands — Two tiny mucous glands which open into the female urethra just at its termination and secrete lubricating fluid

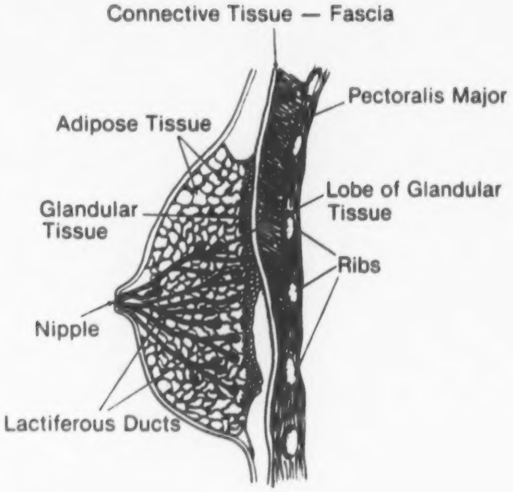
    c. **Perineum** — Region between the vaginal orifice and the anus considered the muscular floor of the pelvis

    Note: The perineum has underlying muscles and fascia and is distendable. It stretches to a remarkable extent during labor and delivery of a baby. It can tear, however. Therefore, it is often incised at childbirth with an episiotomy to prevent tearing.

Information Sheet

24. Breasts (mammary glands)

Figure 8


Connective Tissue — Fascia
Pectoralis Major
Adipose Tissue
Glandular Tissue
Lobe of Glandular Tissue
Ribs
Nipple
Lactiferous Ducts

a. Lie over the pectoralis muscles and are attached to them by a layer of connective tissue (fascia)

b. Estrogens cause their initial growth.

c. Develop at the end of puberty

d. Become functional at end of pregnancy

e. The increase in size of the mammary glands at the time of puberty is due to an increased development of the connective tissue and fat. The glandular tissue remains undeveloped and does not function until conception takes place.

f. Are designed to secrete milk to nourish the young infant

g. The nipples contain the openings of the milk ducts.

h. The nipples are bordered by a circular, pigmented area called the areola.

Note: The areola skin may be pink or dark-colored.

i. Pituitary hormones stimulate the production of colostrum and milk.

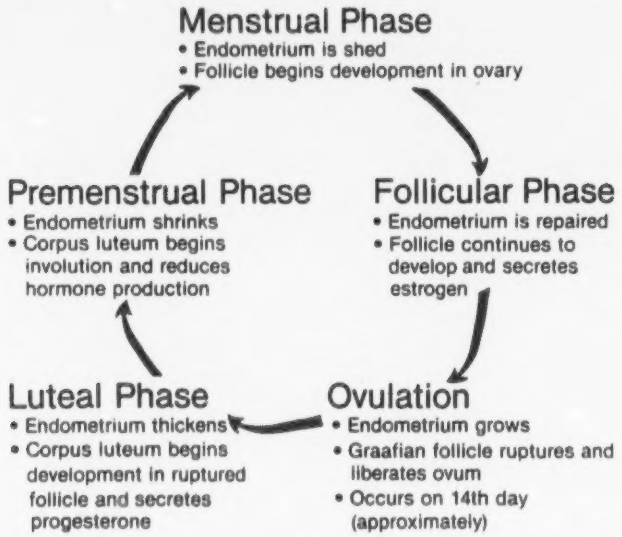
j. The lactiferous glands secrete the colostrum and milk.

k. Are well supplied with blood brought to them by the thoracic branches of the axillary, internal mammary, and intercostal arteries

Information Sheet

25. Phases of the menstrual cycle

Figure 9


Menstrual Phase
• Endometrium is shed
• Follicle begins development in ovary
Follicular Phase
• Endometrium is repaired
• Follicle continues to develop and secretes estrogen
Ovulation
• Endometrium grows
• Graafian follicle ruptures and liberates ovum
• Occurs on 14th day (approximately)
Luteal Phase
• Endometrium thickens
• Corpus luteum begins development in ruptured follicle and secretes progesterone
Premenstrual Phase
• Endometrium shrinks
• Corpus luteum begins involution and reduces hormone production

Note: The menstrual cycle averages 28 days in length although it may vary from 18 to 40 days.

a. Menstrual phase

(1) Period of uterine bleeding accompanied by shedding of the endometrium

(2) Follicle begins to develop in ovary.

(3) Average length is 4 to 5 days.

b. Follicular (proliferative) phase

(1) Endometrium is repaired and thickens.

(2) Follicle continues to develop and secretes estrogen.

(3) Average length is 9 to 10 days.

c. Ovulation

(1) Endometrium continues to grow.

(2) Graafian follicle ruptures and liberates ovum (which moves on io the uterine tubes).

(3) Average occurrence is on the 14th day.

Information Sheet

d. Luteal phase

   (1) Endometrium continues to thicken in preparation for the ovum if it is fertilized.

   (2) Corpus luteum begins to develop in ruptured follicle and secretes progesterone.

   (3) Average length is 10 to 12 days.

   Note: If fertilization occurs, the menstrual cycle is broken and pregnancy beings. If the ovum is not fertilized, the menstrual cycle continues.

e. Premenstrual or ischemic phase

   (1) Arteries constrict and endometrium becomes anemic and shrinks.

   (2) Corpus luteum of ovary begins involution and reduces production of hormones, especially progesterone.

   (3) Average length is 1 or 2 days. Phase ends when cycle begins again with menstruation.

26. Characteristics of menstruation

a. Occurs from age of puberty (10-16 years) to menopause (40-50 years)

b. Onset of menstruation at puberty is referred to as menarche.

c. Menstrual discharge or flow contains endometrial tissue, blood, and serous fluid.

d. Length varies from 3 to 7 days.

e. Average length is 4 to 5 days.

f. Occurs on an average every 27 to 28 days

g. Is brought on by the reduction of ovarian hormones when the ovum is not fertilized

h. Ceases temporarily during pregnancy

i. May or may not cease during lactation

j. Ceases permanently with onset of menopause

k. Failure to occur may result from :

   (1) Emotional or hormonal disturbances

   (2) Physical disorders such as disease or malnutrition

   (3) Congenital disorders

Information Sheet

27. Menstrual irregularities

a. **Amenorrhea** — Absence of flow when normally expected

b. **Oligomenorrhea** — Scanty flow

c. **Dysmenorrhea** — Painful menstruation

d. **Menorrhagia** — Excessive flow (and loss of blood) during menstruation

e. **Metrorrhagia** — Loss of blood during intermenstrual periods; also called spotting

28. Characteristics of pregnancy

a. Pregnancy begins with fertilization of the ovum.

b. As soon as the sperm enters the ovum, cellular changes take place and the embryo begins to form.

c. Umbilical cord is formed and extends from the placenta to the embryo.

d. Through the umbilical cord, two umbilical arteries carry blood from the fetus to the capillaries of the fetal placenta, and the umbilical vein returns the blood to the fetus.

e. It takes about 280 days for the fetus to develop before it is born.

f. The fetus floats in a bag of amniotic fluid.

g. The mother's body performs the function of waste elimination and acquiring cell food for the growth of the fetus by osmosis through the placental membranes.

h. The fetus is delivered when the cervix [illegible] uterus dilates and flattens enough for the fetus to be pushed into the vaginal canal by the muscles in the fundus, body, and vagina.

Reproductive System
Unit 12

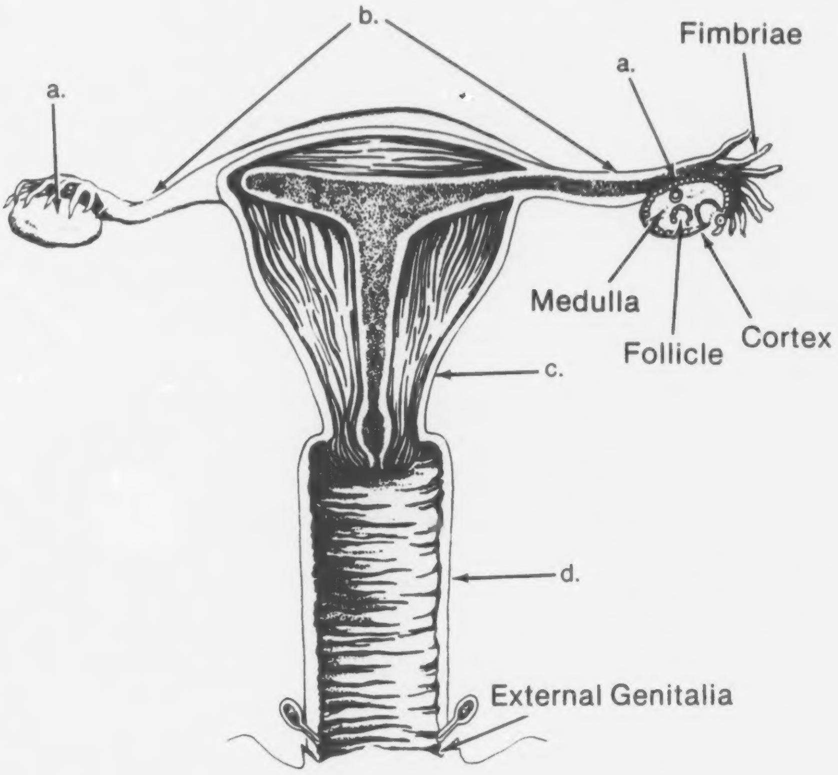
Student Supplement 1—Identify the Internal Female Reproductive Organs

Name ____

Directions: Identify the parts in the following illustration, and place your answers in the blanks provided.

a. ______________________________ c. ______________________________

b. ______________________________ d. ______________________________


b.
Fimbriae
a.
a.
Medulla
Follicle
Cortex
c.
d.
External Genitalia

Reproductive System
Unit 12

Student Supplement 2—Identify the External Female Reproductive Organs

Name ______________________________

Directions: Identify the parts in the following illustration, and place your answers in the blanks provided.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

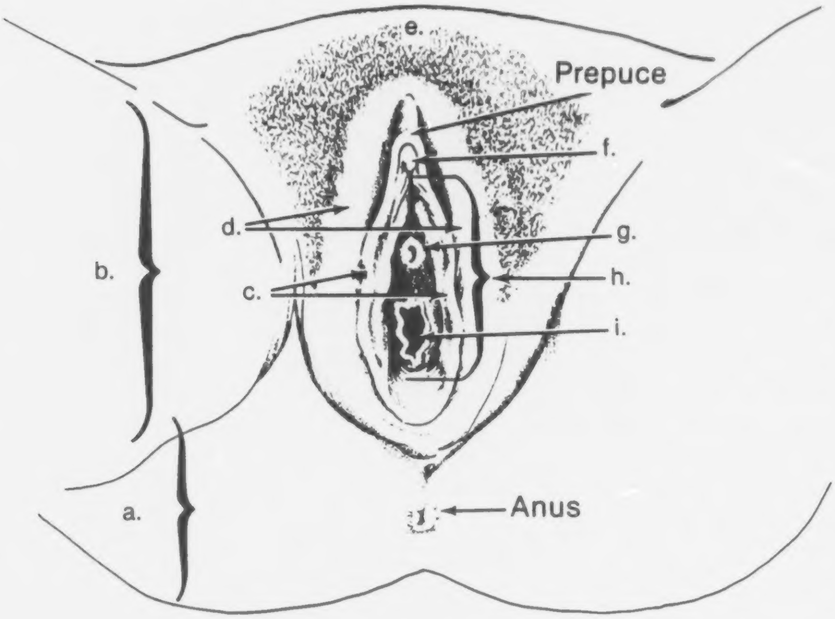
e. ____________________

f. ____________________

g. ____________________

h. ____________________

i. ____________________



Reproductive System
Unit 12

Student Supplement 3—Complete Statements Concerning the Reproductive System

Name ____

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

______ 1. The inner lining of the uterus is called the

a. Peritoneum
b. Endometrium
c. Perineum
d. Myometrium

______ 2. Menstruation depends primarily on

a. Circulating blood
b. Digestion
c. Hormone action
d. Intake of fluids

______ 3. Accessory glands of the female reproductive organs include

a. Cowper's gland
b. Bartholin's gland
c. Vas deferens
d. Prostate

______ 4. Fertilization occurs

a. In the uterine fundus
b. When several sperm penetrate the ovum
c. When the union forms a new one-celled individual
d. When the sperm are ejaculated into the vagina

______ 5. The penis

a. Stores the semen
b. Is the copulatory organ
c. Constitutes the external genitals of the male
d. Stores the gonads

Student Supplement 3

______ 6. The male germ cell is called a

a. Spermatocyte
b. Spermatid
c. Spermatogonium
d. Spermatozoon

______ 7. In the female, the external urinary meatus is located between the

a. Clitoris and vaginal orifice
b. Bladder and urethra
c. Perineum and anus
d. Vagina orifice and perineum

______ 8. One function of the ovaries is

a. Production of ova
b. Secretion of seminal fluid
c. Production of mucus for lubrication
d. To act as a receptacle for fertilized ovum

______ 9. The muscular structure which forms the floor of the pelvis is called the

a. Peritoneum
b. Parietal muscle
c. Mons pubis
d. Perineum

______10. The combination of ducts, nerves, and blood and lymph vessels extending from the scrotum and testes on each side through the abdominal wall is called the

a. Epididymis
b. Spermatic cord
c. Seminal vesicles
d. Phimosis

______11. Ovulation is the process of

a. Producing a mature ovum
b. Beginning the menstrual flow
c. Fertilizing a mature ovum
d. Releasing a mature ovum

Student Supplement 3

______12. Progesterone is secreted by the

a. Adrenal cortex
b. Adrenal medulla
c. Ovary
d. Oviducts

______13. The hormone produced by the male gonads is

a. Progesterone
b. Testosterone
c. Estrogen
d. Estrone

______14. Spermatozoa are formed in the

a. Prepuce
b. Glans penis
c. Prostate gland
d. Testes

______15. The testes are normally situated in the

a. Abdomen
b. Inguinal canal
c. Scrotum
d. Prostate gland

______16. The single tube which conducts urine and sperm to the outside is the

a. Vas deferens
b. Urethra
c. Ejaculatory duct
d. Epididymis

______17. What are the glands of reproduction called?

a. Gametes
b. Zygotes
c. Gonads
d. Morula

______18. Ovulation typically occurs on what day in the menstrual cycle?

a. On the 10th day
b. On the 12th day
c. On the 14th day
d. On the 28th day

______19. The shedding of the functional layer of the endometrium is called

a. Ovulation
b. Graafian follicle
c. Climacteric
d. Menstruation

______20. Menarche is

a. A climacteric period
b. Menopause
c. The onset of menstruation
d. Painful menstruation

______21. The uterine tubes communicate most directly with the

a. Bladder
b. Uterus
c. Ovary
d. Urethra

______22. The fertilized ovum normally implants itself in the wall of the

a. Ovary
b. Fallopian tube
c. Uterus
d. Vagina

______23. The fold of loose skin at the end of the penis is called the

a. Vas deferens
b. Prepuce
c. Urethra
d. Epididymis

______24. The most frequent site for cancer in the male reproductive system is the

a. Seminal vesicles
b. Prostate
c. Bulbourethral gland
d. Testicles

______25. Bleeding between menstrual periods is called

a. Menorrhagia
b. Metrorrhagia
c. Dysmenorrhea
d. Menarche

Student Supplement 3

______26. The pigmented area around the nipples is called

a. Linea alba
b. Skenes
c. Areola
d. Linea niger

______27. The ejaculatory duct opens into the

a. Prostate gland
b. Penis
c. Urinary bladder
d. Urethra

______28. What causes the erection of the penis?

a. The presence of male hormone
b. The presence of semen
c. The stimulation of the testes
d. Increased blood supply

______29. The small sensitive structure which lies superior to the female urinary meatus is the

a. Clitoris
b. Hymen
c. Vulva
d. Labia majora

______30. Which of the following are located one on either side of the vaginal orifice and secrete a lubricating fluid for the vulva canal?

a. Skene's glands
b. Bulbourethral glands
c. Bartholin's glands
d. Cowper's glands

Urinary System
Unit 13

Objective Sheet

Unit Objective

After completing this unit, the student should be able to identify organs of the urinary system and complete statements concerning their characteristics and functions. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the urinary system with their correct definitions.
2. Complete statements concerning the functions of the urinary system.
3. Identify the organs of the urinary system.
4. Complete statements concerning the size, shape, and location of the kidneys.
5. Complete statements concerning the structure of the kidneys.
6. Select functions of the kidneys.
7. Select true statements concerning the formation of calculi in the kidneys.
8. Complete statements concerning the blood and nerve supplies of the kidneys.
9. Complete statements concerning the characteristics and function of the ureters.
10. Complete statements concerning the characteristics and functions of the urinary bladder.
11. Distinguish between the characteristics and functions of the male and female urethra.
12. Complete statements concerning the physical characteristics of urine.
13. Distinguish between normal and abnormal constituents of urine.
14. Complete statements concerning the process of expelling urine.

Urinary System
Unit 13

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Male Urinary System (with Blood Vessels) (Objective 3)
   TM 2—Female Urinary System (Objective 3)
   TM 3—Vertical Section Through a Kidney (Objective 5)
   TM 4—A Simplified Nephron (Objective 5)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplement. This could be used as a homework assignment, daily practice exercise, or quiz. Explain to students how you plan to evaluate the supplement, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Show available films on the urinary system. Skill area: **Communication**

2. Demonstrate the anatomy of the urinary system using illustrations or wall charts.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.

2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.

3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.

4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Videotapes

    a. *I Am Joe's Kidney*, part of the *I Am Joe's* Series available from several sources. Two companies offering this series include the following:

    (1) Medcom/Trainex
    Box 3225
    Garden Grove, CA 92641
    800-877-1443

    (2) Pyramid Film and Video
    P.O. Box 1048
    Santa Monica, CA 90406-1048
    800-421-2304

    b. *Water!*, part of *The Living Body* Series available from:

    Films for the Humanities and Sciences
    P.O. Box 2053
    Princeton, NJ 08543-2053
    800-257-5126 or 609-452-1128

2. Software program—*The Renal System* (Module 5), part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

    Health Sciences Consortium
    201 Silver Cedar Court
    Chapel Hill, NC 27514-1517
    919-942-8731

3. Audiotape—*Urinary System*, part of the *Medical Terminology Made Easy* Series of audiotapes available from:

    Health Sciences Consortium
    201 Silver Cedar Court
    Chapel Hill, NC 27514-1517
    919-942-8731

Suggested Activities

4. Anatomy charts and models on the kidney and urinary system are available from many health and science education companies. Two of these companies are as follows:

    a. Health Edco
    P.O. Box 21207
    Waco, TX 76702-1207
    800-299-3366, x295 or 817-776-6461, x295

    b. Nebraska Scientific
    3823 Leavenworth Street
    Omaha, NB 68105
    800-228-7117

Urinary System
Unit 13

Answers to Student Supplement 1

1. b
2. b
3. b
4. c
5. c
6. d
7. b
8. b
9. c
10. a
11. a
12. d
13. b
14. b
15. c
16. b
17. a
18. c
19. a
20. c
21. a
22. a
23. d
24. b
25. b

Urinary System
Unit 13

Answers to Written Test

1. a. 4
   b. 7
   c. 5
   d. 2
   e. 6
   f. 8
   g. 1
   h. 3

2. a. Blood
   b. Urine
   c. Electrolyte
   d. Pressure

3. a. Kidney
   b. Ureter
   c. Urinary bladder
   d. Urethra

4. a. The shape of
   b. 4½
   c. Twelfth
   d. Behind
   e. Larger
   f. Liver

5. a. (1) Adipose capsule
   (2) Renal fascia
   (3) Hilum
   b. (1) Cortex
   (2) Medulla
   (3) Renal pelvis
   c. Nephron

6. a, b, c, d (all true)

7. c

8. a. Renal
   b. Renal plexus

Answers to Written Test

9. a. ¼
   b. Retroperitoneally
   c. Kidneys to urinary bladder
   d. Renal pelvis
   e. Urinary bladder
   f. Fibrous
   g. Urine

10. a. Muscular
    b. Symphysis pubis
    c. A peritoneal
    d. Symphysis pubis
    e. Rugae
    f. 300 cc. to 500 cc.
    g. Trigone
    h. Urine

11. a. M
    b. M
    c. F
    d. M
    e. F
    f. M
    g. F

12. a. Watery
    b. Clear
    c. Acidic
    d. Water
    e. Amount of fluid taken in
    f. 1000 cc.
    g. Ammonia

13. b. c. d. f. i k. l. m

14. a. Micturition
    b. 200
    c. Adult
    d. Contraction, relaxation
    e. Involuntary
    f. Suppression

Urinary System
Unit 13

Written Test

Name ______________________________ Score ______________

1. Match the terms on the right with the correct definitions.

______ a. The science dealing with the structure and function of the kidney

______ b. Pertaining to the kidney

______ c. The structural and functional unit of the kidney

______ d. A cuplike division of the renal pelvis

______ e. A small, nipplelike protuberance

______ f. A triangular area, especially that area at the base of the bladder

______ g. An abnormal concentration usually composed of mineral salts; commonly called a stone

______ h. Insertion of a tube through the urethra into the urinary bladder to evacuate urine

1. Calculus
2. Calyx
3. Catheterization
4. Nephrology
5. Nephron
6. Papilla
7. Renal
8. Trigone
9. Urology

2. Complete the following statements concerning the functions of the urinary system by filling in the blank with the correct answers.

a. Filters the ______________ by removing various toxins, metabolic waste products, and some water

b. Manufacturers and excretes ______________

c. Assists in regulation of water, ______________, and acid-base balance of the body

d. Influences blood ______________

Written Test

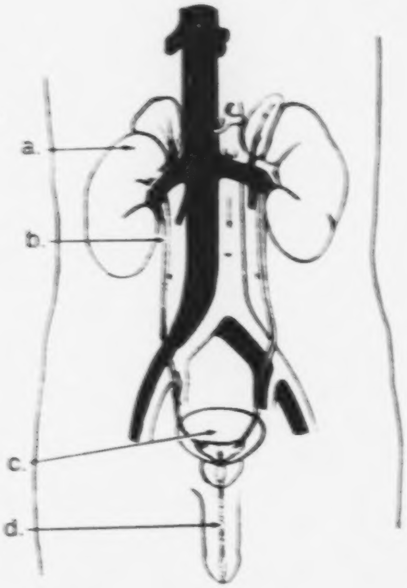
3. Identify the organs of the urinary system, and place your answers in the blanks provided.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________



4. Complete the following statements concerning the size, shape, and location of the kidneys by circling the correct answers.

a. Are (the size of, the shape of) lima beans

b. Measure 2½ inches by (4½, 7½) inches

c. Lie on either side of the vertebral column next to the posterior abdominal wall, near the level of the (fifth, twelfth) thoracic vertebra

d. Lie (in front of, behind) the peritoneum

e. Left kidney is usually slightly (smaller, larger) than the right kidney

f. The right kidney is a little lower than the left, because of the large space occupied by the (liver, heart)

674

Written Test

5. Complete the following statements concerning the structure of the kidneys by filling in the blanks with the correct answers.

   a. External structure

      (1) _________________ — A mass of fatty tissue in which each kidney and its vessels are embedded

      (2) _________________ — A sheath of fibrous tissue which surrounds the kidney and the adipose capsule

      (3) _________________ — A depression on the medial or inner border where the arteries, veins, lymphatic vessels, nerves, ureter, and pelvis enter and leave the kidney

   b. Internal structure

      (1) _________________ — Outer portion that contains secreting portion of the kidney

      (2) _________________ — Middle portion containing renal pyramids which filter waste substances

      (3) _________________ — Inner portion which is small sac or basin-like cavity, having smaller cup-like cavities into which the urine is collected before it is sent into the ureters

   c. Microscopic structure — The _________________ is the physiological unit of the kidney.

6. Select functions of the kidneys by placing an "X" in the appropriate blanks.

   ______a. Secrete urine

   ______b. Regulate the concentration of the various salts circulating in the blood

   ______c. Excrete urine

   ______d. Influence blood pressure

7. Select true statements concerning the formation of calculi in the kidneys by placing an "X" next to the true statements.

   ______a. Calculi may occur in the kidneys, but never in any other part of the urinary tract.

   ______b. Calculi are usually translucent and do not show up on X-ray.

   ______c. Calculi are usually formed by an excessive amount of mineral salts or a decrease in the amount of water.

Written Test

8. Complete the following statements concerning the blood and nerve supplies of the kidneys by filling in the blanks with the correct answers.

   a. Blood supply of the kidneys is from the right and left __________________ arteries and veins.

   b. Nerve supply for the kidneys is derived from the __________________, which is formed by branches from the celiac plexus, the aortic plexus, and from the lesser and lowest splanchnic nerves.

9. Complete the following statements concerning the characteristics and function of the ureters by circling the correct answers.

   a. Are two tubes about 10-12 inches long (27 cm.) and (¼, 2) inch(es) in diameter

   b. Lie (retroperitoneally, suprarenally)

   c. Extend from (kidneys to urinary bladder, urinary bladder to urinary meatus)

   d. Commence as a number of cup-like tubes called calyces in the (urinary bladder, renal pelvis)

   e. End in the posterior floor of the (urinary meatus, urinary bladder)

   f. Have three layers — Inner lining of mucous membrane, middle layer of smooth muscles, and outer wall of (adipose, fibrous) coat

   g. Carry (blood, urine) through peristaltic waves of its muscular layer

10. Complete the following statements concerning the characteristics and functions of the urinary bladder by circling the correct answers.

    a. Is a hollow (adipose, muscular) membranous, collapsible sac or bag

    b. Is located in pelvis directly behind the (rectum, symphysis pubis) and in front of the sigmoid colon

    c. Is held in position by (an abdominal, a peritoneal) fold and fascia

    d. Is protected by the (symphysis pubis, os coxae)

    e. Has (rugae, cilia)

    f. Average capacity is (300 cc. to 500 cc., 600 cc. to 1000 cc.)

    g. The triangular area on the floor of the bladder is called the (triad, trigone) area.

    h. Acts as a reservoir for (mucus, urine)

Written Test

11. Distinguish between the characteristics and functions of the male and female urethra by placing an "F" next to those associated with the female urethra and an "M" next to those describing the male urethra.

_____a. Is divided into three divisions — prostatic, membranous, and cavernous

_____b. Acts as a passageway for urine and seminal fluid

_____c. Is a straight tube

_____d. Is a modified S-shaped tube

_____e. The Skene's glands open into the urethra at its termination to secrete lubricating fluid

_____f. Is about 8 to 10 inches in length

_____g. Is about 1½ inches long and ¼ inch in diameter

12. Complete the following statements concerning the physical characteristics of urine by circling the correct answers.

a. Urine is a (mucosal, watery) solution of the waste products of metabolism.

b. Is an amber or straw-colored (cloudy, clear) liquid

c. Is slightly (alkaline, acidic) with a pH of 5.5 to 6.5

d. Normal specific gravity is 1.015 to 1.025 which is a little heavier than (blood, water).

e. Quantity excreted is dependent upon amount of water lost by evaporation through respiratory and cutaneous surfaces and upon (amount of food eaten, amount of fluid taken in).

f. Average quantity excreted in 24 hours is (400 cc., 1000 cc.) to 1800 cc.

g. Has characteristic odor of (apples, ammonia) after standing for a short period of time

Written Test

13. Distinguish between normal and abnormal constituents of urine by placing an "X" next to the normal constituents.

______a. Acetone

______b. Sodium chloride

______c. Hormones

______d. Uric acid

______e. Pus cells

______f. Water

______g. Blood

______h. Albumin

______i. Urea

______j. Glucose

______k. Calcium

______l. Ammonia

______m. Potassium

14. Complete the following statements concerning the process of expelling urine by circling the correct answers.

a. Is called urination, voiding, or (micturition, picturition)

b. For the average individual when there is (200, 750) cc. of urine in the bladder, the pressure on the bladder walls creates an impulse to urinate.

c. In the (infant, adult) the act of voiding, although dependent on involuntary reflexes, is partly under voluntary control.

d. Urination is accomplished by (relaxation, contraction) of the bladder walls, and (relaxation, contraction) of the sphincter muscles at the junction of the urinary bladder and the urethra.

e. (Voluntary, Involuntary) urination is called incontinence.

f. (Retention, Suppression) of urine is the inability to void because the kidneys are not secreting any urine and the bladder is empty.

***Permission to duplicate this test is granted.**

Urinary System
Unit 13

Unit Evaluation Form

Student Name ______________________________ Unit Rating __________

Written Test Scores

Pretest _____ Posttest _____ Other _____

Other ____

____ ____________________

Teacher Signature ______________________________ Date __________

Student Signature ______________________________ Date __________

*Permission to duplicate this form is granted.

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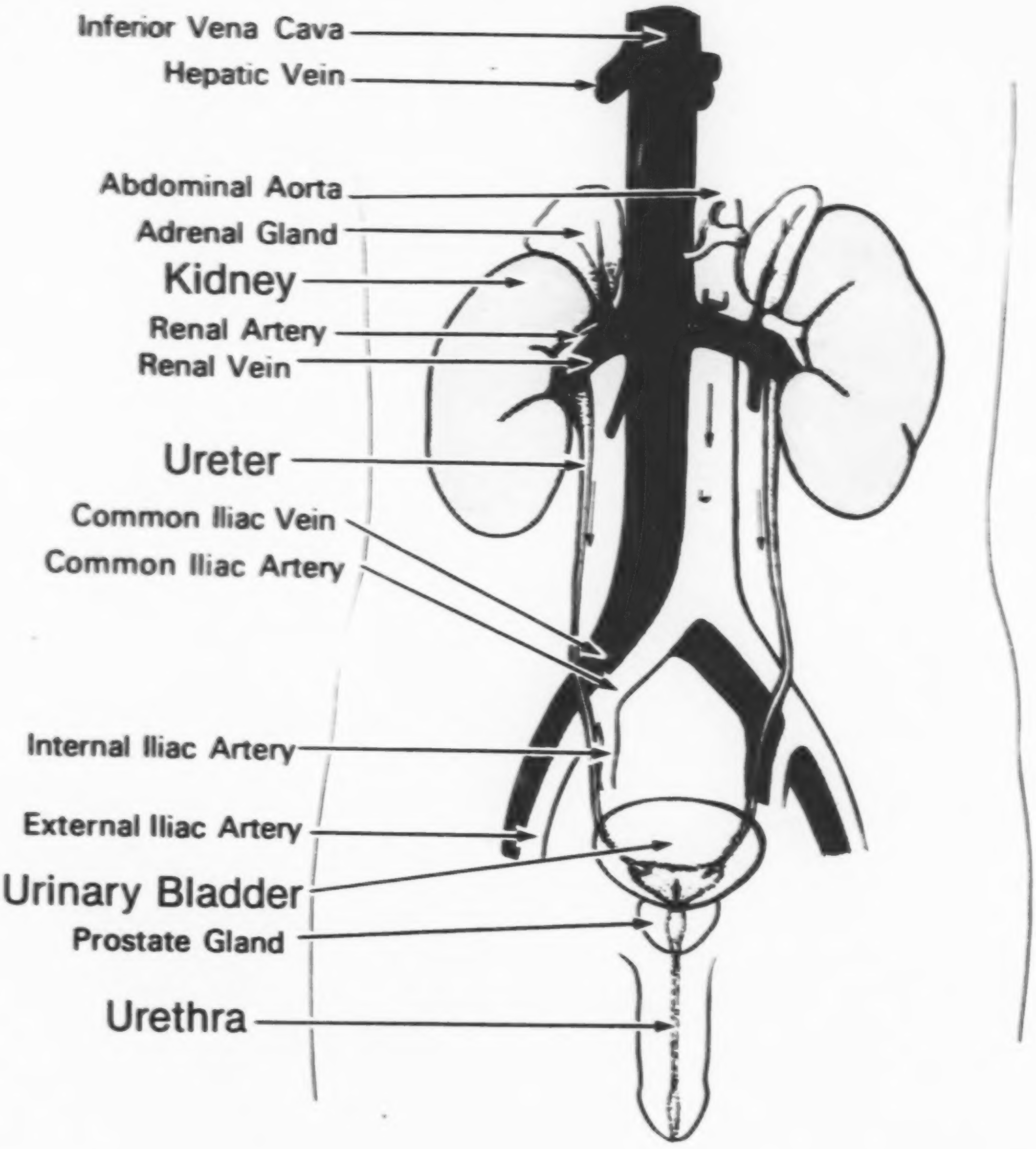
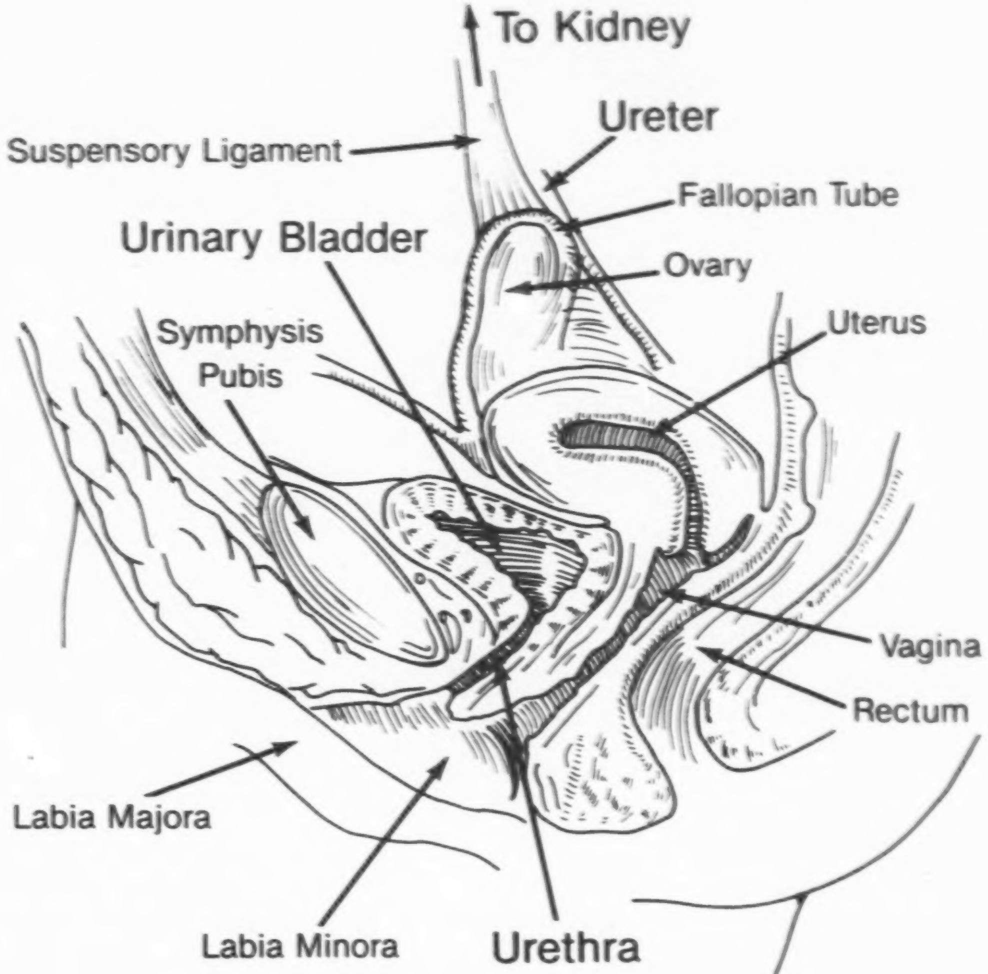
Male Urinary System

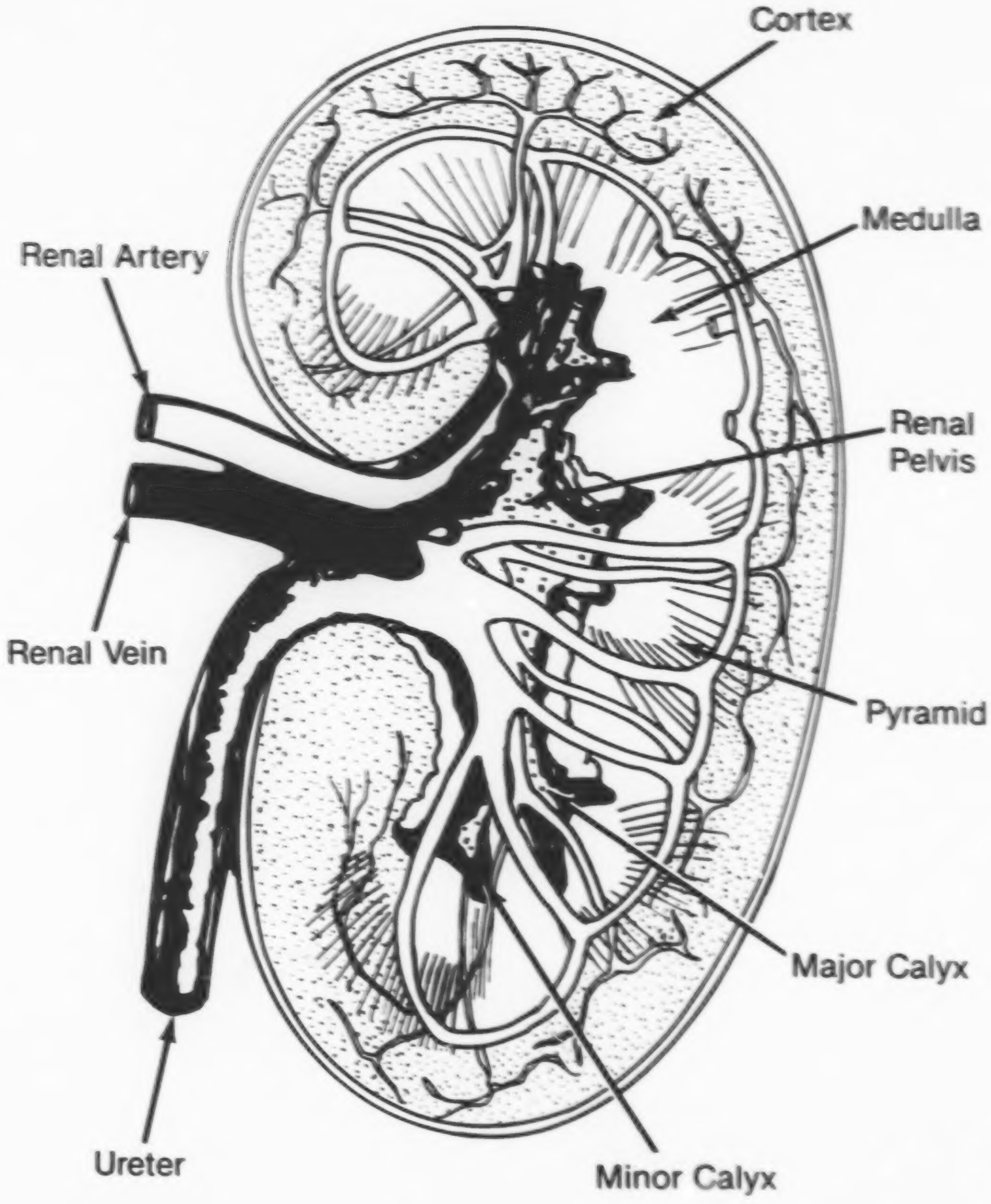
(with Blood Vessels)


Inferior Vena Cava
Hepatic Vein
Abdominal Aorta
Adrenal Gland
Kidney
Renal Artery
Renal Vein
Ureter
Common Iliac Vein
Common Iliac Artery
Internal Iliac Artery
External Iliac Artery
Urinary Bladder
Prostate Gland
Urethra

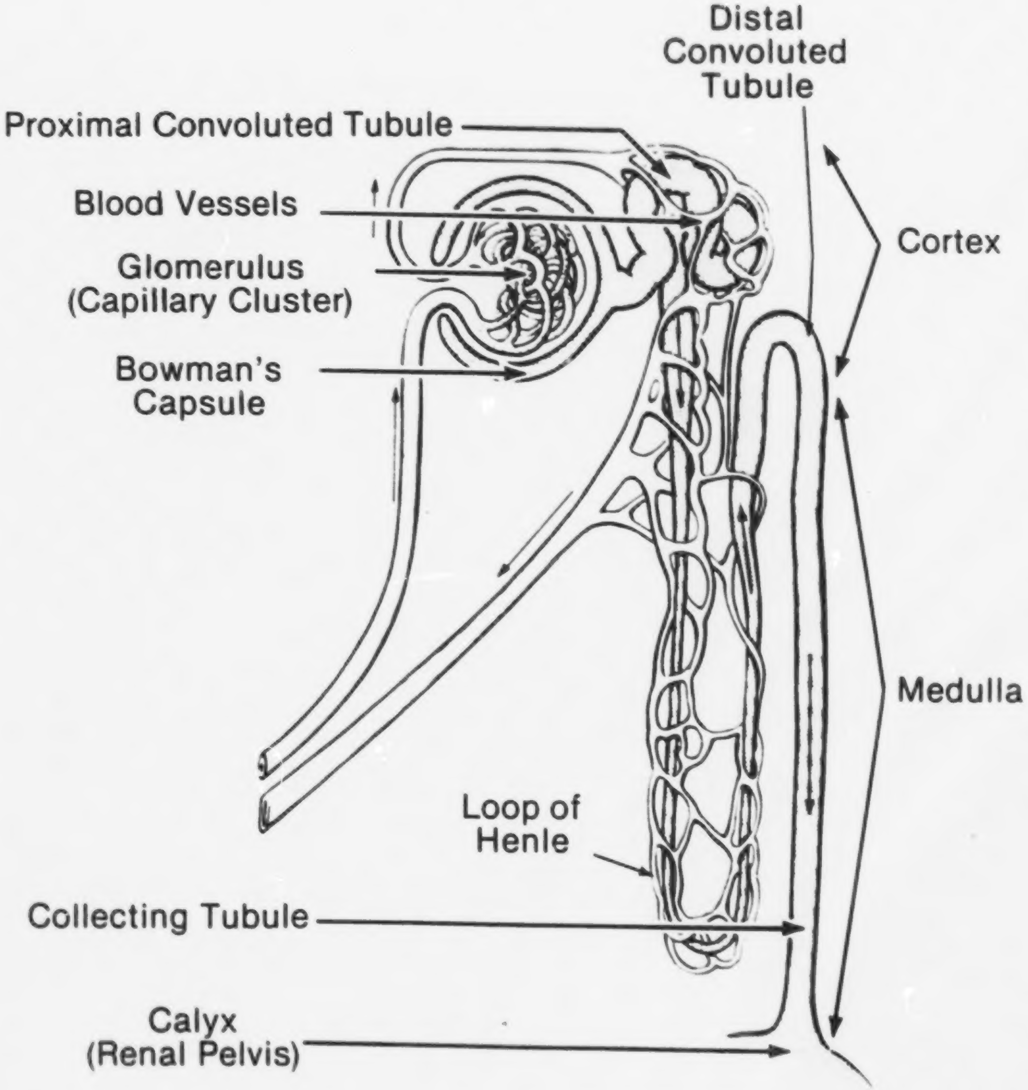
Female Urinary System


To Kidney
Ureter
Suspensory Ligament
Fallopian Tube
Urinary Bladder
Ovary
Symphysis Pubis
Uterus
Vagina
Rectum
Labia Majora
Labia Minora
Urethra

Vertical Section Through a Kidney


Cortex
Medulla
Renal Artery
Renal Pelvis
Renal Vein
Pyramid
Major Calyx
Ureter
Minor Calyx

A Simplified Nephron


Distal Convoluted Tubule
Proximal Convoluted Tubule
Blood Vessels
Cortex
Glomerulus (Capillary Cluster)
Bowman's Capsule
Medulla
Loop of Henle
Collecting Tubule
Calyx (Renal Pelvis)

Urinary System
Unit 13

Information Sheet

1. **Terms and definitions**

   a. **Calculus** (pl. - li) — An abnormal concentration usually composed of mineral salts; commonly called a stone

   b. **Calyx** (pl. - yces) — A cuplike division of the renal pelvis

   Note: Calyces are subdivided into major and minor calyces.

   c. **Catheterization** — Insertion of a tube (catheter) through the urethra into the urinary bladder to evacuate urine

   d. **Nephrology** — The science dealing with the structure and function of the kidney

   e. **Nephron** — The structural and functional unit of the kidney

   f. **Papilla** — A small, nipplelike protuberance

   g. **Renal** — Pertaining to the kidney

   h. **Trigone** — A triangular area, especially that area at the base of the bladder

   i. **Urology** — The branch of medicine concerning the urinary tract in both sexes and the genital tract of the male

2. **Functions of the urinary system**

   a. Filters the blood by removing various toxins, metabolic waste products, and some water

   b. Manufacturers and excretes urine

   c. Assists in regulation of water, electrolyte, and acid-base balance of the body

   d. Influences blood pressure

Information Sheet

3. **Organs of the urinary system**

   a. Two kidneys

   b. Two ureters

   c. Urinary bladder

   d. Urethra

Figure 1—Male

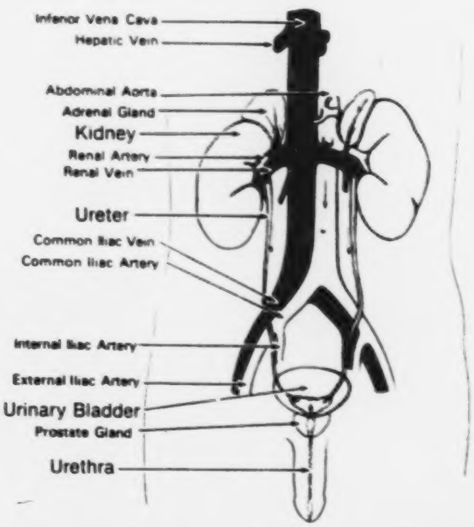
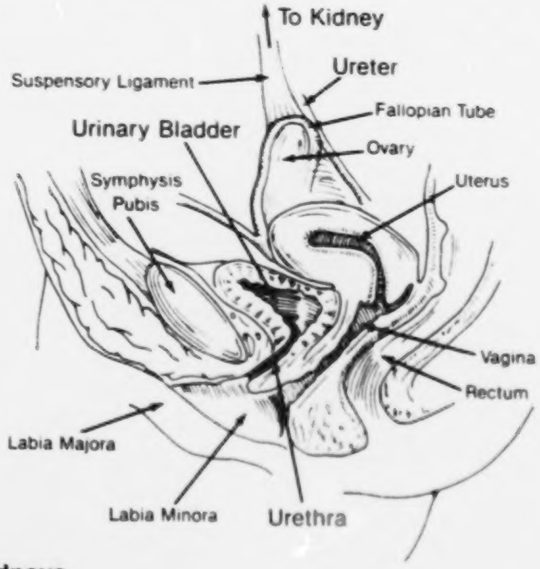

Inferior Vena Cava
Hepatic Vein
Abdominal Aorta
Adrenal Gland
Kidney
Renal Artery
Renal Vein
Ureter
Common Iliac Vein
Common Iliac Artery
Internal Iliac Artery
External Iliac Artery
Urinary Bladder
Prostate Gland
Urethra

Figure 2—Female


To Kidney
Suspensory Ligament
Ureter
Fallopian Tube
Urinary Bladder
Ovary
Symphysis Pubis
Uterus
Vagina
Rectum
Labia Majora
Labia Minora
Urethra

4. **Size, shape, and location of the kidneys**

   a. Measure $2\frac{1}{2}$ inches by $4\frac{1}{2}$ inches (5 to 7.5 cm × 11.25 cm)

   b. Are shaped like lima beans

   c. Lie on either side of the vertebral column next to the posterior abdominal wall, near the level of the twelfth thoracic vertebra

   d. Lie behind the peritoneum (retroperitoneally)

   e. Left kidney is usually slightly larger than the right kidney

   f. The right kidney is a little lower than the left, because of the large space occupied by the liver.

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Information Sheet

5. Structure of the kidneys

a. External structure

(1) **Adipose capsule** — A mass of fatty tissue in which each kidney and its vessels are embedded; hold kidneys in position

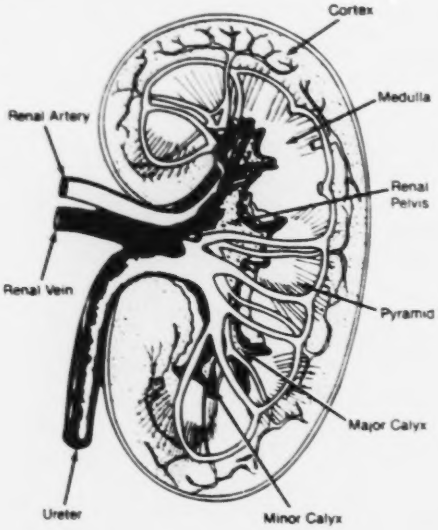
(2) **Renal fascia** — A sheath of fibrous tissue which surrounds the kidney and the adipose capsule; hold kidneys in position

(3) **Hilum** — A depression on the medial or inner border where the arteries, veins, lymphatic vessels, nerves, ureter, and pelvis enter and leave the kidney

(4) **Renal pelvis** — The funnel-shaped sac at the hilum

b. Internal structure

Figure 3—Vertical section through a kidney



(1) **Cortex** (cortical substance) — Outer portion that contains secreting portion of the kidney

(2) **Medulla** (medullary substance) — Middle portion containing renal pyramids which filter waste substances

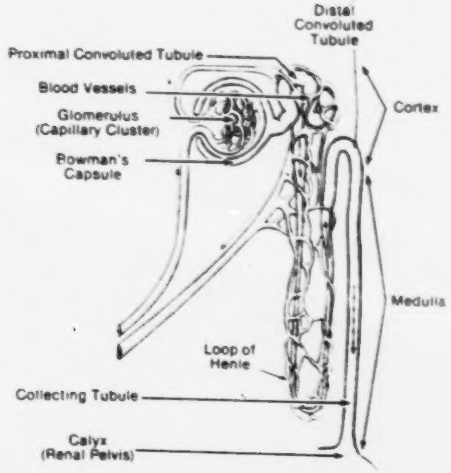
(3) **Renal pelvis** — Inner portion which is small sac or basin-like cavity, having smaller cup-like cavities (calyces) into which the urine is collected before it is sent into the ureters

Information Sheet

c. Microscopic structure

(1) Nephron

Figure 4—A simplified nephron


Distal Convoluted Tubule
Proximal Convoluted Tubule
Blood Vessels
Glomerulus (Capillary Cluster)
Bowman's Capsule
Cortex
Medulla
Loop of Henle
Collecting Tubule
Calyx (Renal Pelvis)

- (a) Physiological unit of the kidney
- (b) Approximately 1 million in each kidney
- (c) Resembles a tiny funnel with a very long convoluted stem
- (d) Consists of a renal corpuscle and tubules

(2) Renal corpuscle — Consists of glomerulus, a network of capillaries enclosed within Bowman's capsule

(3) Renal tubules — Consist of proximal convoluted tubule, loop of Henle, distal convoluted tubule, and collecting tubule

(4) The distal part of the nephron is located in the cortex, and draws off and filters the liquid portion of the blood, removes liquid wastes (urine), and returns the usable portion to circulation.

(5) The proximal part of the nephron is located in the medulla, and collects the urine and channels it to the ureter.

Information Sheet

6. **Functions of the kidneys**

   a. Secrete (manufacture) urine

   Note: The secretion of urine is a constant process. The exact way in which the kidneys secrete the urine is not known, but it is thought to depend upon the following factors: the capillary blood pressure in the glomeruli, the velocity of blood flow through the renal vessels, and the physiological activity of the cells lining the renal tubules.

   b. Excrete urine

   c. Influence blood pressure

   d. Regulate the fluid content of the blood by separating out the constituents of urine from the blood

   e. Regulate the concentration of the various salts circulating in the blood

   f. Extract foreign substances from the body, such as toxins, whether formed in the body or taken into the body from the outside

   Note: Diffusion, filtration, and osmosis occur during the production of urine in the kidneys.

   g. Regulate osmotic pressure of extracellular fluid

   h. Regulate electrolyte and acid-base balance

7. **Formation of calculi in the kidneys**

   a. May occur in the kidneys or any other part of the urinary tract

   b. Are usually radiopaque since they contain calcium

   c. Are usually formed by

      (1) Excessive amount of mineral salts (calcium, sodium)

      (2) Decrease in the amount of water

      (3) Excessively acidic or alkaline urine

Information Sheet

8. Blood and nerve supplies of the kidneys

a. Blood supply of the kidneys

- (1) Right and left renal arteries
    - (a) Branches of the descending abdominal aorta
    - (b) Just before entering the kidney at the hilum, each artery divides into several branches which have two destinations:
        - 1) The cortical substance of the kidney
        - 2) The medullary substance of the kidney
- (2) Right and left renal veins
    - (a) Collect blood from the kidneys
    - (b) Empty into the inferior vena cava

b. Nerve supply for the kidneys

- (1) Derived from the renal plexus, which is formed by branches from the celiac plexus, the aortic plexus, and from the lesser and lowest splanchnic nerves
- (2) Accompany the renal arteries and their branches and are distributed to the blood vessels
- (3) Are vasomotor nerves which control the circulation of blood in the kidneys by regulating the contraction and dilation of the blood vessels

9. Characteristics and function of the ureters

a. Are two tubes about 10-12 inches long (27 cm.) and ¼ inch in diameter

b. Lie retroperitoneally

c. Extend from kidneys to urinary bladder

d. Commence as a number of cup-like tubes called calyces in the renal pelvis

e. End in the posterior floor of the urinary bladder

f. Have three layers — Inner lining of mucous membrane, middle layer of smooth muscles, and outer wall of fibrous coat

g. Carry urine through peristaltic waves of its muscular layer

Information Sheet

10. **Characteristics and functions of the urinary bladder**

    a. Is a hollow, muscular, membranous, collapsible sac or bag

    b. Is located in pelvis directly behind the symphysis pubis and in front of the sigmoid colon

    c. Is held in position by a peritoneal fold and fascia

    d. Is protected by the symphysis pubis

    e. Has rugae

    f. Size varies according to the amount of urine present

    g. Average capacity is 300 cc. to 500 cc.

    h. The triangular area on the floor of the bladder is called the trigone area, and is formed by the three openings into the bladder

        (1) Right ureter on side

        (2) Left ureter on side

        (3) Urethra in front

    i. Acts as a reservoir for urine

    j. Empties urine into the urethra by contraction of muscular walls

11. **Characteristics and functions of the male and female urethra**

    a. Female urethra

        (1) Is a short, straight tube

        (2) Is about 1½ inches long and ¼ inch in diameter

        (3) Lies behind the symphysis pubis

        (4) Is embedded in the anterior wall of the vagina

        (5) Acts as a passageway for urine from bladder to the urinary meatus

        (6) Contains an internal and an external sphincter

        (7) The Skene's glands open into the urethra at its termination to secrete lubricating fluid.

Information Sheet

b. Male urethra

  (1) Is a modified S-shaped tube

  (2) Is about 8 to 10 inches in length

  (3) Immediately below the bladder it passes through the center of the prostate gland, then through two sheets of white, fibrous tissue connecting the pubic bones, and then through the penis

  (4) Is divided into three divisions:

    (a) Prostatic — Passes vertically through the prostate gland
    (b) Membranous — Extends between the apex of the prostate and the bulb of urethra, passes through the pelvic walls, and is surrounded by the external sphincter muscle
    (c) Cavernous or anterior — Extends through the penis from the membranous to the urinary meatus

  (5) Acts as a passageway for urine and seminal fluid

12. Physical characteristics of urine

a. Is a watery solution of the waste products of metabolism

b. Is an amber or straw-colored clear liquid

Note: The color is from excreted bile pigments.

c. Is slightly acidic with a pH of 5.5 to 6.5 (average pH is 6.0)

d. Normal specific gravity is 1.015 to 1.025 which is a little heavier than water.

e. Quantity excreted is dependent upon:

  (1) Amount of water lost by evaporation through respiratory and cutaneous surfaces

  (2) Amount of fluid intake

f. Average quantity excreted in 24 hours is 1000 cc. to 1800 cc.

g. Has characteristic odor of ammonia after standing for a short period of time

Information Sheet

13. Constituents of urine

a. Normal constituents

  (1) Water (95%)

  (2) Organic substances (protein waste products)

    (a) Uric acid
    (b) Urea
    (c) Creatinine
    (d) Ammonia
    (e) Hormones

  (3) Inorganic substances (mineral salts)

    (a) Sodium chloride
    (b) Sulfates and phosphates
    (c) Potassium
    (d) Magnesium
    (e) Calcium

b. Abnormal constituents

  (1) Glucose (glycosuria)

  Note: This is one symptom of diabetes mellitus.

  (2) Albumin (albuminuria)

  (3) Blood (hematuria)

  (4) Pus cells (pyuria)

  (5) Acetone (acetonuria)

14. Process of expelling urine

a. Is called urination, voiding, or micturition

b. For the average individual, when there is 200 to 250 cc. of urine in the bladder, the pressure on the bladder walls creates an impulse (message to central nervous system) to urinate.

c. In the adult the act of voiding, although dependent on involuntary reflexes, is partly under voluntary control.

Information Sheet

d. Urination is accomplished by contraction of the bladder walls, and relaxation of the sphincter muscles at the junction of the urinary bladder and the urethra.

e. Involuntary urination is called incontinence.

f. Retention of urine is the inability to void, but the bladder contains much urine and must be emptied (usually by catheterization).

g. Suppression of urine is the inability to void because the kidneys are not secreting any urine and the bladder is empty.

Urinary System
Unit 13

Student Supplement 1—Complete Statements Concerning the Urinary System

Name ____

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

______ 1. Urine drains from the kidneys to the bladder through the

a. Urethra
b. Ureters
c. Renal pelvis
d. Renal tubules

______ 2. The female urethra is located

a. Between the kidney and bladder
b. Anterior to the vagina
c. Posterior to the vagina
d. Between the bafina and the trigone

______ 3. The normal pH of urine is about

a. 8.0
b. 6.0
c. 3.0
d. 9.0

______ 4. The functioning unit of the urinary system is the

a. Glomerulus
b. Cortex
c. Nephron
d. Afferent and efferent arteriole

______ 5. Diffusion, filtration, and osmosis occur during the production of urine in the

a. Ureter
b. Urinary bladder
c. Kidney
d. Adipose capsule

Student Supplement 1

______ 6. The production and elimination of urine includes the organs of the urinary system in the order of

a. Cortex, urethra, bladder, ureter
b. Kidney, urethra, bladder, ureter
c. Kidney, pelvis, ureter, bladder
d. Kidney, ureter, bladder, urethra

______ 7. Urine not only passes down through the ureters by gravity, but also is forced down by

a. Crenation
b. Peristalsis
c. Osmosis
d. Mitosis

______ 8. The kidney is located in an area known as the

a. Mediaperitoneal space
b. Retroperitoneal space
c. Trigone space
d. Retrocecal space

______ 9. What percentage of urine is water?

a. 100%
b. 60%
c. 95%
d. 75%

______10. Urine is normally

a. Clear, light, straw-colored
b. Alkaline in reaction
c. pH 9
d. Strongly aromatic

______11. Blood vessels and nerves enter the kidney at the

a. Hilum
b. Cortex
c. Calyx
d. Loop of Henle

Student Supplement 1

______12. A normal waste product in urine is

a. Albumin
b. Blood
c. Glucose
d. Urea

______13. Three principal parts of the kidney are

a. Medulla, nephron, ureter
b. Medulla, cortex, renal pelvis
c. Glomerulus, Bowman's capsule, cortex
d. Prostate gland, urethra, blood vessels

______14. Which is **NOT** a term meaning specifically "to expel urine?"

a. Micturition
b. Elimination
c. Voiding
d. Urination

______15. The male urethra may be divided into three parts—the membranous, the cavernous, and the

a. Testicular
b. Seminal
c. Prostatic
d. Triangular

______16. The average individual first receives the impulse to urinate when there is how much urine in the bladder?

a. 500 cc.
b. 200 cc.
c. 750 cc.
d. 1000 cc.

______17. The cup-like cavities in the pelvis of the kidney are

a. Calyces
b. Calculi
c. Pyramids
d. Capsules

Student Supplement 1

______18. The presence of an abnormal amount of glucose in the urine is

a. Hydronephrosis
b. Diuresis
c. Glycosuria or glucosuria
d. Hyperglycemia

______19. Blood in the urine is know as

a. Hematuria
b. Pyuria
c. Dysuria
d. Pyelitis

______20. Failure of the kidneys to secrete urine is called

a. Oliguria
b. Retention of urine
c. Suppression of urine or anuria
d. Dysuria

______21. The section of the male urethra which passes through the pelvic wall is known as the

a. Membranous
b. Seminal
c. Cavernous
d. Prostatic

______22. There are approximately __________________ nephrons in each kidney.

a. 1 million
b. 50 million
c. 50 thousand
d. 10 million

______23. The __________________ glands secrete lubricating fluid into the female urethra.

a. Pituitary
b. Bartholin
c. Renal
d. Skene

Student Supplement 1

______24. ____________________ is another name for stones.

a. Cortex
b. Calculi
c. Calyces
d. Calyx

______25. All the following are functions of the kidneys **EXCEPT**

a. Regulate electrolyte balance
b. Regulate number of white blood cells
c. Regulate concentration of salts in blood
d. Regulate osmotic pressure of extracellular fluid

Endocrine System
Unit 14

Objective Sheet

Unit Objective

After completing this unit, the student should be able to identify the principal endocrine glands and complete statements concerning their characteristics and the hormones they secrete. The student should demonstrate these competencies by scoring a minimum of 85 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to the endocrine glands with their correct definitions.
2. State the function of the endocrine glands.
3. Select physiological processes affected by hormones.
4. Identify the principal endocrine glands.
5. Select true statements concerning the pituitary gland.
6. Distinguish between the hormones of the pituitary gland according to their locations.
7. Match hormones of the pituitary gland with the correct functions.
8. Complete statements concerning the thyroid gland.
9. Complete statements concerning the parathyroid glands.
10. Select true statements concerning the adrenal glands.
11. Match the principal hormones of the adrenal glands with the correct functions.
12. Complete statements concerning the gonads.
13. Select true statements concerning the Islands of Langerhans.
14. Select true statements concerning other structures with endocrine functions.
15. Match disorders of the endocrine glands with the correct causes.

Endocrine System
Unit 14

Suggested Activities

Instructional Plan

Preparation

1. Read the unit carefully and plan for instruction.

2. Review Teaching Suggestions section that follows. Plan for classroom activities.

3. Plan for students with special needs.

4. Make transparencies from the transparency masters included with this unit. These appear in the teacher edition only and are designed to be used with the following objectives:

   TM 1—Endocrine System (Objective 4)
   TM 2—Pituitary Gland (Objective 5)

5. Obtain films, videotapes, and other resources to supplement instruction of this unit. See ordering information in the Suggested Supplemental Resources section that follows.

6. Develop teaching plan. Adjust for different learning styles.

7. Make copies of Unit Evaluation Form.

Delivery and Application

8. Provide students with unit of instruction.

9. Discuss unit and specific objectives.

10. Discuss information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.

11. Discuss the student supplements. These could be used as homework assignments, daily practice exercises, or quizzes. Explain to students how you plan to evaluate the supplements, if at all.

Suggested Activities

Evaluation

12. Discuss the use of the Unit Evaluation Form with students. Discuss the rating scale that will be used for student evaluation.

13. Make copies of the written test. Add or modify test items as needed.

14. Give written test.

15. Record written test scores on the Unit Evaluation Form. Add any additional assignments or supplemental activities that should be part of the unit evaluation.

16. Reteach and retest as required.

Teaching Suggestions

Note: Skill areas appearing in boldface type in the Teaching Suggestions refer to the academic and workplace skills identified by the American Society for Training and Development (ASTD) and the U.S. Department of Labor. These have been adapted by MAVCC.

1. Show available films concerning the endocrine system. Skill area: **Communication**

2. Demonstrate the anatomy of the various endocrine glands using illustrations or models.

3. Discuss the importance of the endocrine glands during surgery since they influence the functioning of all systems of the body, the rate of absorption of medications and anesthetic agents, and the patient's ability to recover from surgery. Skill area: **Communication**

4. Discuss the difference between the exocrine glands and the endocrine glands.

Resources Used in Developing This Unit

1. Anthony, Catherine P. and Gary A. Thibodeau. *Textbook of Anatomy and Physiology*, 12th ed. St. Louis: C. V. Mosby Company, 1987.

2. Hole, John W. *Human Anatomy and Physiology*, 5th ed. Dubuque, IA: Wm. C. Brown Company Publishers, 1990.

3. Jacob, Stanley W. and Clarice A. Francone. *Elements of Anatomy and Physiology*, 3rd ed. Philadelphia: W. B. Saunders Company, 1989.

4. Memmler, Ruth Lundeen and Dena Lin Wood. *The Human Body in Health and Disease*, 6th ed. New York: J. B. Lippincott Company, 1987.

Suggested Activities

Suggested Supplemental Resources

1. Videotape—*Messengers*, part of *The Living Body* Series available from:

   Films for the Humanities and Sciences
   P.O. Box 2053
   Princeton, NJ 08543-2053
   800-257-5126 or 609-452-1128

2. Software program—*The Endocrine-Metabolic System* (Module 10), part of the *Learning the Sciences Basic to Medicine* Series developed by the Ohio State University College of Medicine. Hardware requirements: IBM/MS-DOS compatible microcomputer with 640 kB of RAM, VGA graphics, and at least a 720 Kb floppy disk drive. Software is available from:

   Health Sciences Consortium
   201 Silver Cedar Court
   Chapel Hill, NC 27514-1517
   919-942-8731

3. Anatomy charts and models on the endocrine system are available from many health and science education companies. Two of these companies are as follows:

   a. Health Edco
   P.O. Box 21207
   Waco, TX 76702-1207
   800-299-3366, x295 or 817-776-6461, x295

   b. Nebraska Scientific
   3823 Leavenworth Street
   Omaha, NB 68105
   800-228-7117

Endocrine System
Unit 14

Answers to Student Supplements

Student Supplement 1

a. Parathyroid glands
b. Thyroid gland
c. Pineal body
d. Pituitary gland
e. Thymus
f. Adrenal glands
g. Islands of Langerhans in pancreas
h. Ovaries
i. Testes

Student Supplement 2

a. Anterior
b. Thyrotropic (TTH)
c. Follicle-stimulating hormone (FSH)
d. Luteinizing hormone (LH)
e. Vasopressin
f. Oxytocin
g. Melanocyte-stimulating hormone (MSH)
h. Thyroid gland
i. Parethormone
j. Adrenal glands
k. Androgens
l. Estrogens
m. Progesterone
n. Medulla
o. Norepinephrine
p. Testes
q. Estrogens
r. Insulin
s. Melatonin
t. Thymus gland
u. Progesterone
v. Gastrin
w. Small intestine (duodenal) wall

Student Supplement 3

1. a
2. c
3. d
4. b
5. c
6. c
7. b
8. a
9. a
10. b
11. b
12. a
13. d
14. c
15. c
16. c
17. c
18. d
19. a
20. d
21. c
22. a
23. b
24. c
25. c

Endocrine System
Unit 14

Answers to Written Test

1. a. 1
   b. 3
   c. 2
   d. 5
   e. 4

2. To secrete substances called hormones

3. All are correct

4. a. Pituitary gland
   b. Parathyroid glands
   c. Thyroid glands
   d. Adrenal glands
   e. Islands of Langerhans
   f. Ovaries
   g. Testes

5. b, d, e, f, h

6. a. A
   b. A
   c. P
   d. A
   e. A
   f. B
   g. P
   h. A
   i. A
   j. A

7. a. 4
   b. 1
   c. 8
   d. 5
   e. 3
   f. 7
   g. 9
   h. 6

8. a. Largest
   b. Two
   c. Thyroxine
   d. Iodine
   e. Proteins
   f. Carbohydrate
   g. Somatotropin

Answers to Written Test

9. a. Four, posterior
   b. Parathormone
   c. Hypocalcemia
   d. Decreases

10. b, f, g

11. a. 5
    b. 3
    c. 4
    d. 1
    e. 7
    f. 2

12. a. Ovaries
    b. Testes

13. b, c, d, g

14. c, e

15. a. 13
    b. 2
    c. 10
    d. 5
    e. 9
    f. 12
    g. 4
    h. 8
    i. 14
    j. 1
    k. 6
    l. 7

Endocrine System
Unit 14

Written Test

Name ______________________________ Score ____________

1. Match the terms on the right with the correct definitions.

______a. A ductless gland that produces an internal secretion discharged into the blood or lymph and circulated to all parts of the body

______b. A gland whose secretion reaches an epithelial surface either directly or through a duct

______c. The science studying the endocrine glands and their functions

______d. A substance containing amino acid which originates in an organ or gland, moves through the blood to another part of the body, and stimulates it (by chemical action) to increased activity and secretion

______e. Excessive amounts of hormones are secreted

1. Endocrine gland
2. Endocrinology
3. Exocrine gland
4. Hypersecretion
5. Hormone

2. State the function of the endocrine glands.

____

3. Select physiological processes affected by hormones by placing an "X" in the appropriate blanks.

______a. Rate of metabolism

______b. Growth and development processes

______c. Development and functioning of the reproductive organs

______d. Ability of body to meet conditions of stress

______e. Sexual characteristics and libido

Written Test

4. Identify the principal endocrine glands and place your answer in the blanks provided.

a. ______________________

b. ______________________

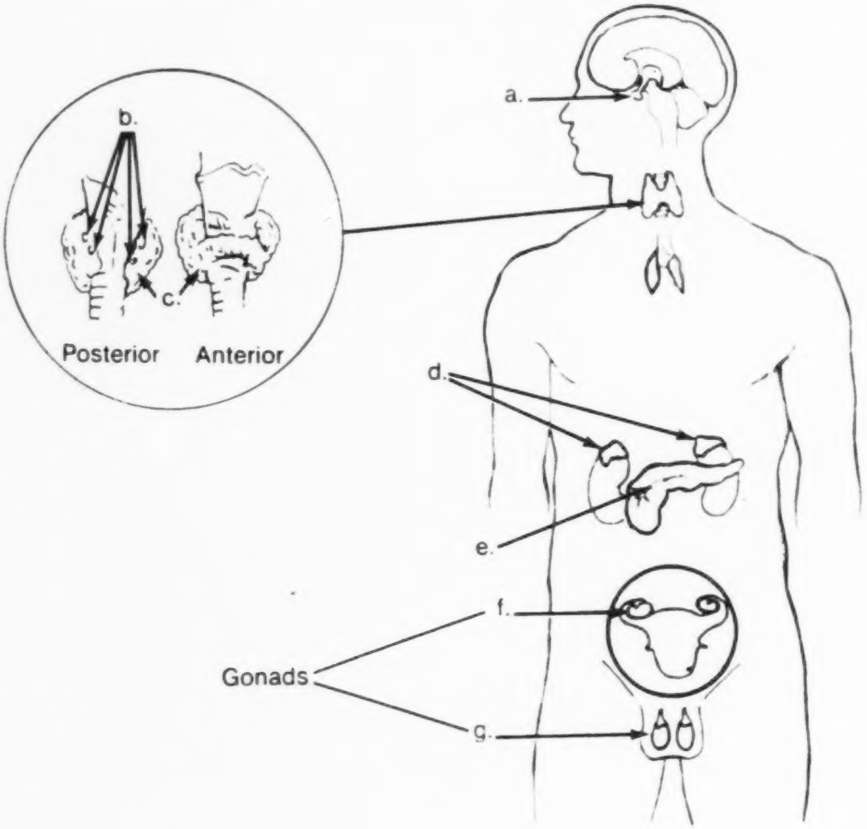
c. ______________________

d. ______________________

e. ______________________

f. ______________________

g. ______________________


a.
b.
c.
Posterior
Anterior
d.
e.
f.
Gonads
g.

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Written Test

5. Select true statements concerning the pituitary gland by placing an "X" next to the true statements.

_____a. Is also called the thymus

_____b. Is a small, gray rounded body attached to the base of the brain by a stalk

_____c. Lies in a small depression of the nasal bone

_____d. Known as the "master" gland or the "moderator" because it influences other glands

_____e. Is divided into anterior and posterior lobes which have separate functions

_____f. The posterior lobe is connected through the stalk to the hypothalamus.

_____g. Posterior lobe secretes only one hormone.

_____h. Anterior lobe secretes several hormones.

6. Distinguish between the hormones of the pituitary gland according to their locations by placing a "P" next to those in the posterior lobe, an "A" next to those in the anterior lobe, and a "B" for the hormone(s) found between the lobes.

_____a. Somatotropic hormones (STH)

_____b. Adrenocorticotropic hormone (ACTH)

_____c. Vasopressin

_____d. Thyrotropic hormone (TTH)

_____e. Gonadotropic hormones

_____f. Melanocyte-stimulating hormone (MSH)

_____g. Oxytocin

_____h. Follicle-stimulating hormone (FSH)

_____i. Luteinizing hormone (LH)

_____j. Luteotropic hormone (LTH)

Written Test

7. Match hormones of the pituitary gland on the right with the correct functions.

_____a. Stimulates development of ovarian follicles and spermatogenesis in the testes

_____b. Induces secretion of estrogens, ovulation, and development of the corpus luteum

_____c. Maintains mature corpora lutea, induces secretion of progesterone, and induces secretion of milk in a fully developed mammary gland

_____d. Regulates growth

_____e. Influences melanin formation

_____f. Induces contraction of smooth muscles of the blood vessels affecting blood pressure; is associated with an antidiuretic principle which prevents excessive loss of water through the kidneys; causes reabsorption of water in nephron tubules

_____g. Regulates functional activity of the adrenal cortex

_____h. Regulates functional activity of the thyroid gland

1. Luteinizing hormone
2. Oxytocin
3. Melanocyte-stimulating hormone
4. Follicle-stimulating hormone
5. Somatotropic hormone
6. Thyrotropic hormone
7. Vasopressin
8. Luteotropic hormone
9. Adrenocorticotropic hormone

8. Complete the following statements concerning the thyroid gland by circling the correct answers.

a. Is the (smallest, largest) of all endocrine glands

b. Is a glandular structure consisting of (two, four) lobes on either side of the trachea connected in the midline by the isthmus

c. Secretes the hormone (thyroxine, thyrotropin)

d. (Sodium, Iodine) must be present in sufficient amounts in the body in order for the hormone secreted by the thyroid gland to be synthesized

Written Test

e. The thyroid hormone is transported in the blood by binding itself to (oxygen, proteins).

f. Thyroid hormones aid in regulating metabolism, especially (protein, carbohydrate) and fat metabolism.

g. Thyroid hormones affect (adrenalin, somatotropin) secretion and function.

9. Complete the following statements concerning the parathyroid glands by circling the correct answers.

a. (Two, Four) small bean-shaped bodies which lie on the (anterior, posterior) surface of the thyroid lobes

b. Secrete the hormone (thyroxin, parathormone)

c. Helps maintain homeostasis of blood calcium concentration by promoting calcium absorption into the blood, thereby preventing (hypocalcemia, hypercalcemia)

d. Neuromuscular irritability is inversely related to blood calcium concentration; that is, neuromuscular irritability increases when the blood concentration of calcium (increases, decreases)

10. Select true statements concerning the adrenal glands by placing an "X" next to the true statements.

______a. Are also called the renals

______b. Are located superior to the kidneys fitting like a cap

______c. Consist of two parts which are dependent on each other

______d. The cortex is the inner portion, and the medulla is the outer portion.

______e. The adrenal cortex is not essential to life.

______f. The adrenal medulla is not essential for life.

______g. Complete removal of both adrenals would result in death unless substitute hormones are administered to the individual.

Written Test

11. Match the principal hormones of the adrenal glands on the right with the correct functions.

______ a. Regulates metabolism of sodium, chloride, and potassium, and therefore, regulates water and electrolyte balance of body

______ b. Regulate principally carbohydrate as well as fat and protein metabolism which affects essentially every cell in the body

______ c. Regulate the development and maintenance of male secondary sexual characteristics

______ d. Responsible for female secondary sexual characteristics and the cyclic changes in the vagina and uterus

______ e. Responsible for changes in the uterine lining in second half of menstrual cycle, for development of maternal placenta, and for development of mammary glands

______ f. Dilates arteries, increases heart activity, dilates bronchi, increases level of glucose in blood by stimulating liver, increases amount of fatty acid in blood, and diminishes activity of gastrointestinal system

1. Estrogens
2. Epinephrine
3. Cortisol and corticosterone
4. Androgens
5. Aldosterone
6. Norepinephrine
7. Progesterone

12. Complete the following statements concerning the gonads by filling in the blanks with the correct answers.

a. ____________________ secrete several hormones including estrogens and progesterone.

b. ____________________ secrete androgens including testosterone and androsterone.

Written Test

13. Select true statements concerning the Islands of Langerhans by placing an "X" next to the true statements.

_______a. Are the same thing as the pancreas

_______b. Manufacture two hormones—insulin and glucagon

_______c. Insulin is necessary for the normal use of sugar in the body and increases the rate of glucose metabolism.

_______d. Decreased production of insulin metabolizes sugar too slowly or not at all and sugar is excreted in the urine.

_______e. Increased production of insulin metabolizes sugar too slowly or not at all and sugar is excreted in the urine.

_______f. Glucagon tends to decrease the blood glucose concentration.

_______g. Glucagon serves as an antagonist to insulin since it accelerates the conversion of glycogen to glucose in the liver.

14. Select true statements concerning other structures with endocrine functions by placing an "X" next to the true statements.

_______a. The pineal body is a small conical organ which lies near the middle of the brain that influences sexual, skeletal, and mental maintenance in the later years of life.

_______b. The thymus gland is located on the posterior side of the kidney.

_______c. The thymus gland produces hormones that stimulate the production of the small lymphocytes which function in the body's defense against infection, especially in the immune response of the newborn.

_______d. Removal of the thymus gland will result in death if supplementary hormones are not given.

_______e. The placenta becomes a temporary endocrine gland during pregnancy, and secretes chorionic gonadotropins, estrogens, and progesterones whose increased levels delay menstruation.

_______f. The stomach wall secretes the hormone secretin which stimulates the secretion of the gastric glands.

_______g. The small intestine (duodenal) wall secretes the hormone gastrin which stimulates the secretion of pancreatic juices and bile.

Written Test

15. Match disorders of the endocrine glands on the right with the correct causes.

______ a. Hyposecretion of vasopressin

______ b. Hyposecretion of somatotropic hormone in childhood or hereditary

______ c. Hypersecretion of somatotropic hormone in childhood

______ d. Hypersecretion of somatotropic hormone in adults characterized by enlargements of the bones of the hands, feet, jaw, and cheeks

______ e. Any enlarged thyroid whether it is secreting too little, too much, or a normal amount of thyroxine

______ f. Hypersecretion of thyroxine resulting in an exophthalmic goiter characterized by increased appetite, weight loss, increased rate of metabolism, nervous irritability, and protruding of the eye

______ g. Hyposecretion of thyroxine in adults characterized by decreased metabolism, increased weight, hair loss, and thickening of skin due to fluid accumulation

______ h. Hyposecretion of thyroxine in childhood characterized by stunted growth and mental retardation

______ i. Hyposecretion of insulin and lack of metabolism of sugar characterized by elevated blood sugar, sugar in urine, excessive urine production, and excess thirst

______ j. Hypersecretion of insulin characterized by deficiency of sugar in the blood

1. Hypoglycemia
2. Dwarfism
3. Hypercalcemia
4. Myxedema
5. Acromegaly
6. Tetany
7. Addison's disease
8. Cretinism
9. Goiter
10. Giantism
11. Cushing's syndrome
12. Grave's disease
13. Diabetes insipidus
14. Diabetes mellitus

Written Test

_______k. Hyposecretion of parathormone characterized by muscular excitability and irritability resulting in death if calcium treatment is not given

_______l. Hypofunction of the adrenal cortex especially aldosterone and the cortisones as well as melanocyte-stimulating hormone characterized by weakness, nausea, weight loss, increased pigmentation of skin, irregular milk-white patches on the skin, and water and electrolyte disturbances

*Permission to duplicate this test is granted.

Endocrine System
Unit 14

Unit Evaluation Form

Student Name ______________________ Unit Rating __________

Written Test Scores

Pretest ______ Posttest ______ Other ______

Other ____

____

Teacher Signature ______________________ Date __________

Student Signature ______________________ Date __________

*Permission to duplicate this form is granted.

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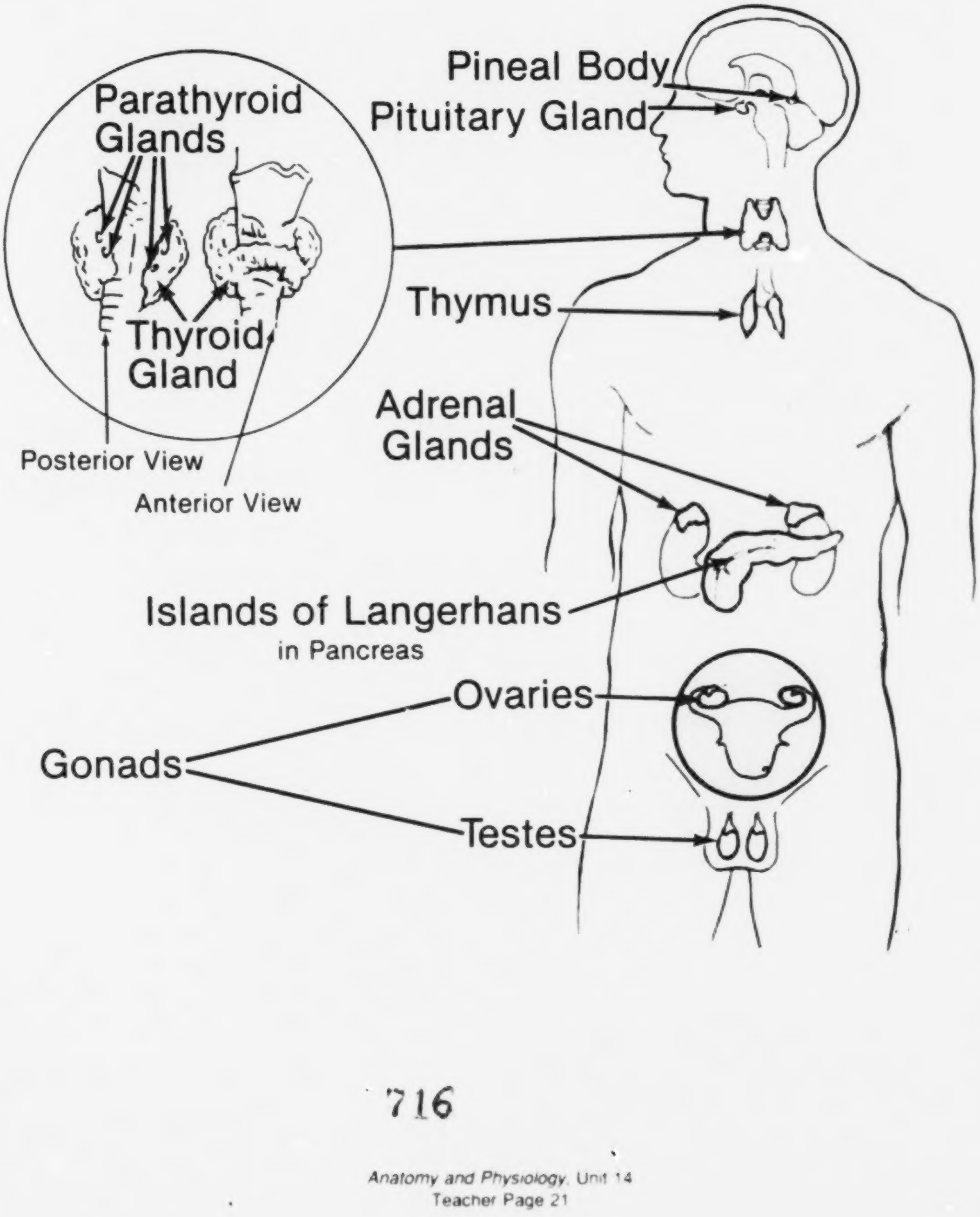
Endocrine System


Parathyroid Glands
Thyroid Gland
Posterior View
Anterior View
Pineal Body
Pituitary Gland
Thymus
Adrenal Glands
Islands of Langerhans
in Pancreas
Ovaries
Gonads
Testes

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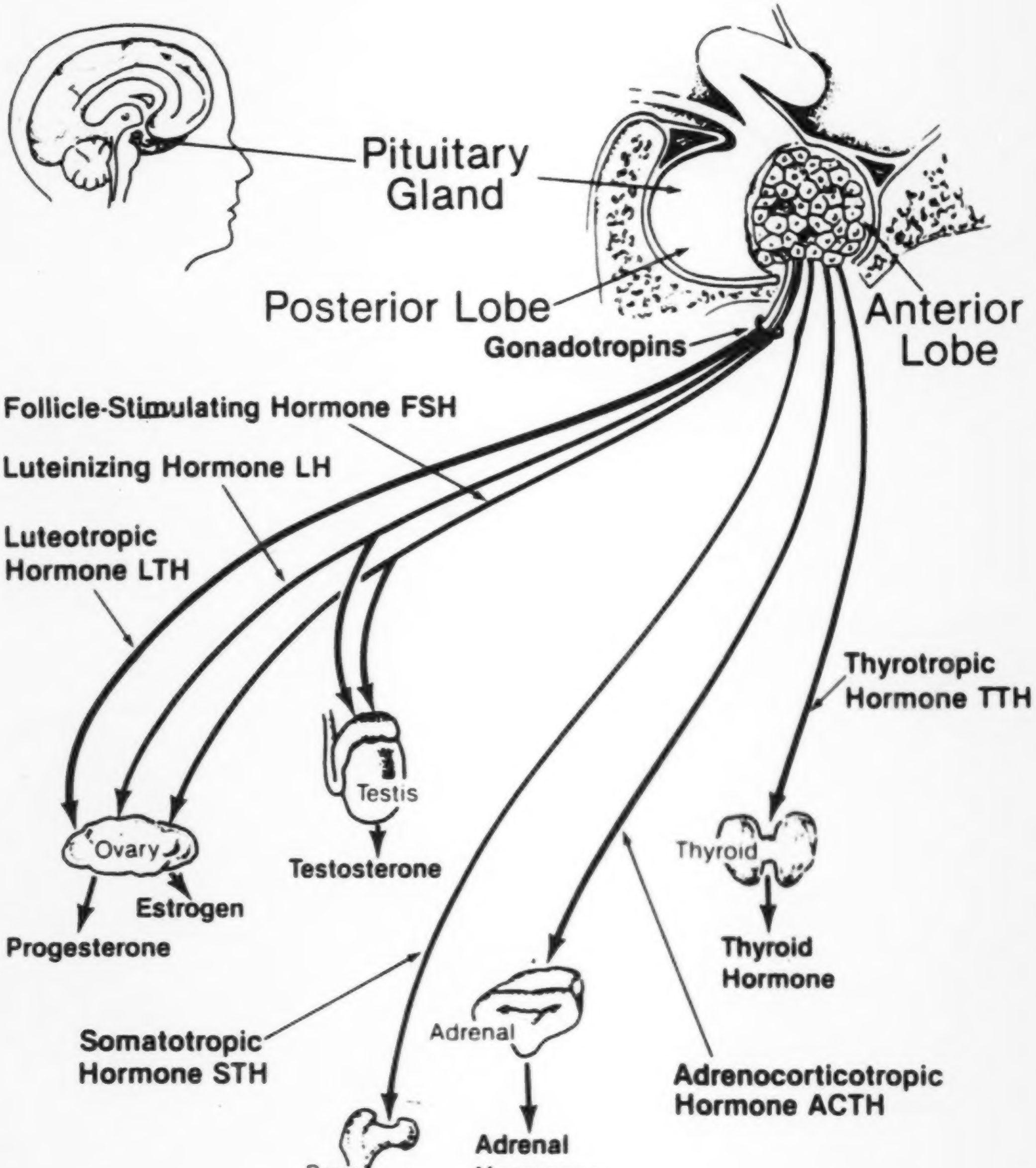
Pituitary Gland


Pituitary Gland
Posterior Lobe
Anterior Lobe
Gonadotropins
Follicle-Stimulating Hormone FSH
Luteinizing Hormone LH
Luteotropic Hormone LTH
Testis
Testosterone
Ovary
Estrogen
Progesterone
Thyrotropic Hormone TTH
Thyroid
Thyroid Hormone
Somatotropic Hormone STH
Adrenal
Adrenal Hormones
Adrenocorticotropic Hormone ACTH
Bone

Endocrine System
Unit 14

Information Sheet

1. **Terms and definitions**

   a. **Endocrine gland** — A ductless gland that produces an internal secretion discharged into the blood or lymph and circulated to all parts of the body

      Example: Thyroid gland

   b. **Endocrinology** — The science studying the endocrine glands and their functions

   c. **Exocrine gland** — A gland whose secretion reaches an epithelial surface either directly or through a duct

      Example: Salivary gland

   d. **Hormone** — A substance containing amino acid which originates in an organ or gland, moves through the blood to another part of the body, and stimulates it (by chemical action) to increased activity and secretion

   e. **Hypersecretion** — Excessive amounts of hormones are secreted

   f. **Hyposecretion** — Inadequate amounts of hormones are secreted

2. **Function of the endocrine glands** — To secrete substances called hormones

3. **Physiological processes affected by hormones**

   a. Rate of metabolism

   b. Metabolism of specific substances such as carbohydrates and calcium

   c. Growth and development processes

   d. Secretory activity of other hormones

   e. Development and functioning of the reproductive organs

   f. Sexual characteristics and libido

   g. Development of higher mental functions

   h. Ability of body to meet conditions of stress

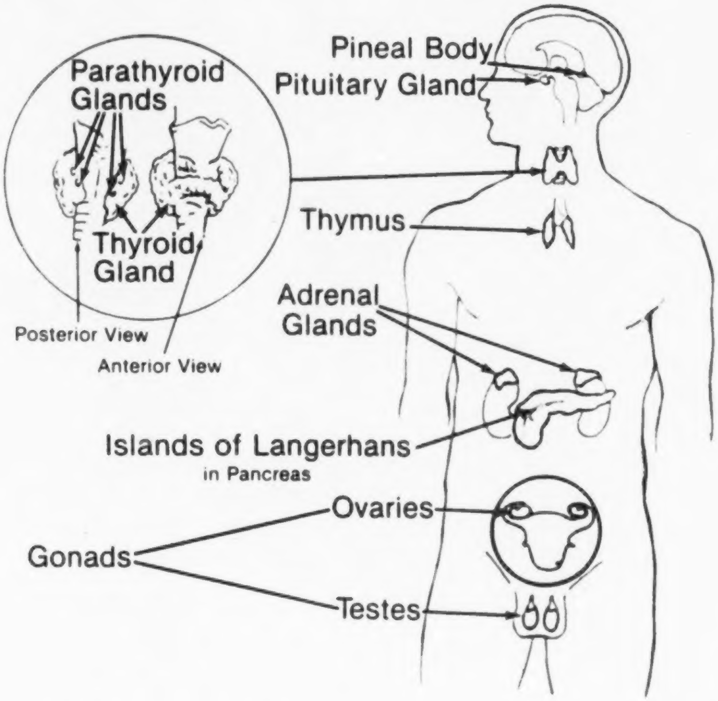
   i. Resistance to disease

   Note: The hormones secreted by the endocrine glands may affect a specific organ or tissue or the entire body.

Information Sheet

4. Principal endocrine glands and their locations

Figure 1


Pineal Body
Pituitary Gland
Parathyroid Glands
Thyroid Gland
Posterior View
Anterior View
Thymus
Adrenal Glands
Islands of Langerhans
in Pancreas
Ovaries
Gonads
Testes

a. Pituitary gland — At base of brain

b. Thyroid glands — In anterior portion of neck

c. Parathyroid glands (4) — Near thyroid gland

d. Adrenal (suprarenal) glands (2) — Above each kidney

e. Gonads

   (1) Testes — In scrotum

   (2) Ovaries — In female pelvic cavity

f. Islands of Langerhans — In the pancreas

Information Sheet

5. Pituitary gland

a. Is also called the hypophysis cerebri

b. Is a small, gray rounded body attached to the base of the brain by a stalk

c. Lies in a small depression of the sphenoid bone of the cerebrum known as the sella turcica

d. Known as the "master" gland or the "moderator" because it influences other glands

e. Its hormones affect the functioning of several other endocrine glands including

   (1) Thyroid

   (2) Adrenal

   (3) Ovary

   (4) Testes

f. Is divided into anterior and posterior lobes which have separate functions

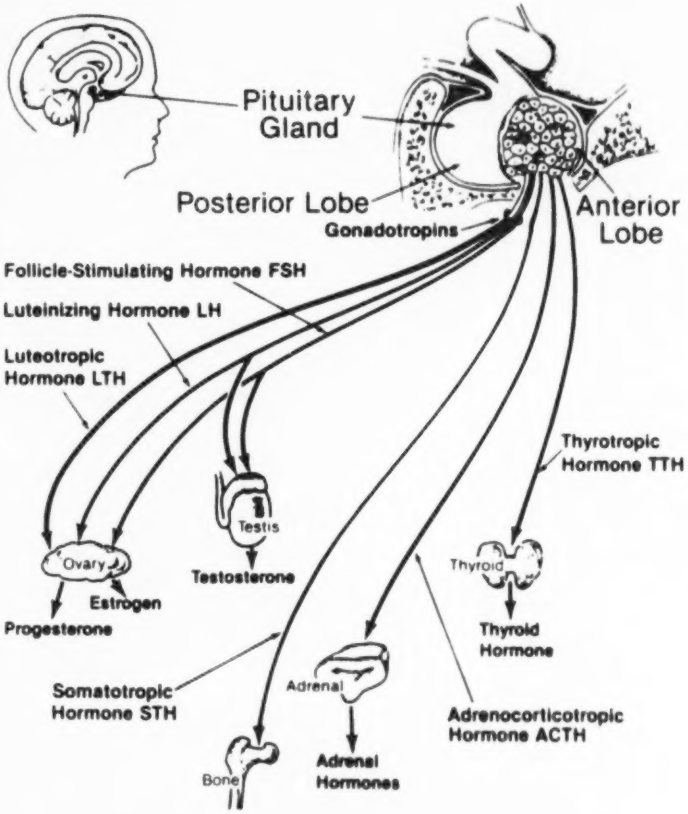
g. The posterior lobe is connected through the stalk to the hypothalamus.

h. Posterior lobe secretes two hormones produced by the hypothalamus.

i. Anterior lobe secretes several hormones.

Information Sheet

Figure 2


Pituitary Gland
Posterior Lobe
Anterior Lobe
Gonadotropins
Follicle-Stimulating Hormone FSH
Luteinizing Hormone LH
Luteotropic Hormone LTH
Thyrotropic Hormone TTH
Testis
Ovary
Testosterone
Estrogen
Progesterone
Thyroid
Thyroid Hormone
Somatotropic Hormone STH
Adrenal
Adrenocorticotropic Hormone ACTH
Adrenal Hormones
Bone

6. **Locations of the hormones of the pituitary gland (hypophysis)**

   a. Posterior lobe (neurohypophysis)

      (1) Vasopressin

      (2) Oxytocin

   b. Anterior lobe (adenohypophysis)

      (1) Somatotropic hormones (STH)

      (2) Adrenocorticotropic hormone (ACTH)

      (3) Thyrotropic hormone (TTH)

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Information Sheet

(4) Gonadotropic hormones

  (a) Follicle-stimulating hormone (FSH)
  (b) Luteinizing hormone (LH)
  (c) Luteotropic hormone (LTH)

c. Between anterior and posterior lobe — Melanocyte-stimulating hormone (MSH)

7. Hormones of the pituitary gland and their functions

a. **Vasopressin** — Induces contraction of smooth muscles of the blood vessels affecting blood pressure; is associated with an antidiuretic principle which prevents excessive loss of water through the kidneys; causes reabsorption of water in nephron tubules

Note: For this last reason vasopressin is also called the antidiuretic hormone — ADH.

b. **Oxytocin** — Stimulates the uterus to contract and acts on the mammary gland to stimulate the release of milk

Note: Commercial forms of oxytocin include Pitocin® and Syntocinon® which are used to increase uterine contractions.

c. **Somatotropic hormone (STH)** — Regulates growth

Note: This is also referred to as the human growth hormone — HGH.

d. **Adrenocorticotropic hormone (ACTH)** — Regulates functional activity of the adrenal cortex

e. **Thyrotropic hormone (TTH)** — Regulates functional activity of the thyroid gland

f. **Gonadotropic hormones**

(1) **Follicle-stimulating hormone (FSH)** — Stimulates development of ovarian follicles and spermatogenesis (formation of sperm) in the testes

(2) **Luteinizing hormone (LH)** — Induces secretion of estrogens, ovulation, and development of the corpus luteum

(3) **Luteotropic hormone (LTH)** — Maintains mature corpora lutea, induces secretion of progesterone, and induces secretion of milk in a fully developed mammary gland

Note: For this last reason, LTH is sometimes called the lactogenic hormone or prolactin.

g. **Melanocyte-stimulating hormone (MSH)** — Influences melanin formation

Information Sheet

8. Thyroid gland

a. Is the largest of all endocrine glands

b. Is a glandular structure consisting of two lobes on either side of the trachea connected in the midline by the isthmus

c. Secretes the hormone thyroxine

d. Iodine must be present in sufficient amounts in the body in order for thyroxine to be synthesized.

Note: It is the thyrotropic hormone produced by the anterior lobe of the pituitary gland which promotes the uptake of iodine and the synthesis and release of thyroxine.

e. Thyroxine is transported in the blood by binding itself to proteins.

f. Thyroid function is indicated by the measurement of protein-bound iodine (PBI) in the plasma.

g. Thyroid hormones aid in regulating metabolism, especially carbohydrate and fat metabolism.

h. Thyroid hormones affect somatotropin secretion and function.

Note: In the absence of the thyroid hormone, the growth hormone does not have its normal growth-promoting actions.

i. The thyroid hormones are required for normal development of the central nervous system.

9. Parathyroid glands

a. Four, small bean-shaped bodies which lie on the posterior surface of the thyroid lobes

b. Secrete the hormone parathormone (parathyroid hormone)

c. Parathormone helps maintain homeostasis of blood calcium concentration by promoting calcium absorption into the blood, thereby preventing hypocalcemia.

d. Neuromuscular irritability is inversely related to blood calcium concentration; that is, neuromuscular irritability increases when the blood concentration of calcium decreases.

Information Sheet

10. **Adrenal glands**

    a. Are also called the suprarenals

    b. Are located superior to the kidneys fitting like a cap

    c. Consist of two parts which function independently

       (1) Cortex — Outer portion

       (2) Medulla — Inner portion

    d. The adrenal cortex is essential to life because it assists the body to adapt to the constant changes in the environment.

    e. The adrenal medulla is not essential for life, but functions in conjunction with the sympathetic nervous system to help individuals meet certain types of emergency situations.

    f. Complete removal of both adrenals would result in death unless substitute hormones are administered to the individual.

11. **Principal hormones of the adrenal glands and their functions**

    a. Hormones of the adrenal cortex

       (1) Aldosterone — Regulates metabolism of sodium, chloride, and potassium, and therefore, regulates water and electrolyte balance of body

       (2) Cortisol and corticosterone — Regulate principally carbohydrate as well as fat and protein metabolism which affects essentially every cell in the body

       (3) Androgens (male sex hormones) such as testosterone and androsterone — Regulate the development and maintenance of male secondary sexual characteristics

       (4) Estrogens (female sex hormones) such as estradiol and estrone — Responsible for female secondary sexual characteristics and the cyclic changes in the vagina and uterus

       (5) Progesterone — Responsible for changes in the uterine lining in second half of menstrual cycle, for development of maternal placenta, and for development of mammary glands

Information Sheet

b. Hormones of the adrenal medulla

Note: These are known as "fight or flight" hormones because of their effect during emergency situations.

(1) Epinephrine (adrenalin) — Dilates arteries, increases heart activity, dilates bronchi, increases level of glucose in blood by stimulating liver, increases amount of fatty acid in blood, and diminishes activity of gastrointestinal system

(2) Norepinephrine — Constricts arterioles and venules which results in increased resistance to blood flow, elevated blood pressure, and slowing of the heart

12. Gonads

a. Ovaries (female gonads) — Secrete several hormones including estrogens and progesterone

(1) Estrogens such as the hormones estradiol and estrone — Responsible for female secondary sexual characteristics and the cyclic changes in the vagina and uterus

(2) Progesterone — Responsible for changes in the uterine lining in second half of menstrual cycle, for development of maternal placenta, and for development of mammary glands

b. Testes (male gonads) — Secrete androgens including testosterone and androsterone which regulate the development and maintenance of male secondary sexual characteristics

13. Islands of Langerhans

a. Are special cells scattered throughout the pancreas

b. Manufacture two hormones—insulin and glucagon

c. Insulin

(1) Is necessary for the normal use of sugar in the body and increases the rate of glucose metabolism

(2) Decreased production of insulin metabolizes sugar too slowly or not at all and sugar is excreted in the urine (glycosuria)

(3) Increased production of insulin metabolizes sugar too fast

Information Sheet

d. Glucagon

(1) Serves as an antagonist to insulin since it accelerates the conversion of glycogen to glucose (glycogenolysis) in the liver

(2) Tends to decrease the blood glucose concentration

14. Other structures with endocrine functions

a. Pineal body

(1) Is a small conical organ which lies near the middle of the brain

(2) Influences sexual, skeletal, and mental development in the first seven years of life, and then becomes inactive

(3) Synthesizes the hormone melatonin, which exerts an inhibitory effect on the gonads

b. Thymus gland

(1) Is a two-lobed organ located in the upper part of the chest cavity along the trachea

(2) Produces hormones that stimulate the production of the small lymphocytes which function in the body's defense against infection, especially in the immune response of the newborn

(3) Secretes a substance called thymosin which promotes the growth of peripheral lymphoid tissue

(4) Is most active during prenatal life and infancy

(5) An enlarged thymus can impair breathing and circulation in a newborn infant because of its location.

(6) The thymus can be removed without causing serious damage, but may result in increased susceptibility to acute infections later.

(7) The thymus decreases in size after puberty.

Information Sheet

c. Placenta

  (1) Becomes a temporary endocrine gland during pregnancy

  (2) Secretes chorionic gonadotropins, estrogens, and progesterones whose increased levels delay menstruation.

  Note: The presence of chorionic gonadotropins in urine is the basis for pregnancy tests.

d. Stomach wall — Secretes the hormone gastrin which stimulates the secretion of the gastric glands

e. Small intestine (duodenal) wall — Secretes the hormone secretin which stimulates the secretion of pancreatic juices and bile

15. Disorders of the endocrine glands and their causes

a. Disorders of the pituitary gland

  (1) Diabetes insipidus — Hyposecretion of vasopressin (antidiuretic hormone)

  (2) Dwarfism — Hyposecretion of somatotropic hormone (growth hormone) in childhood or hereditary causes

  (3) Giantism — Hypersecretion of somatotropic hormone in childhood

  (4) Acromegaly — Hypersecretion of somatotropic hormone in adults characterized by enlargements of the bones of the hands, feet, jaw, and cheeks

b. Disorders of the thyroid gland

  (1) Goiter — Any enlarged thyroid whether it is secreting too little, too much, or a normal amount of thyroxine

  (2) Grave's disease — Hypersecretion of thyroxine resulting in an exophthalmic goiter characterized by increased appetite, weight loss, increased rate of metabolism, nervous irritability, and protruding of the eye (exophthalmia)

  (3) Myxedema — Hyposecretion of thyroxine in adults characterized by decreased metabolism, increased weight, hair loss, and thickening of skin due to fluid accumulation

  (4) Cretinism — Hyposecretion of thyroxine in childhood characterized by stunted growth and mental retardation

Information Sheet

c. Disorders of the parathyroid glands

  (1) Tetany — Hyposecretion of parathormone characterized by muscular excitability and irritability resulting in death if calcium treatment is not given

  (2) Hypercalcemia — Hypersecretion of parathormone

d. Disorders of the adrenal gland

  (1) Addison's disease — Hypofunction of the adrenal cortex, especially aldosterone and the cortisones, as well as melanocyte-stimulating hormone, characterized by weakness, nausea, weight loss, increased pigmentation of skin, irregular milk-white patches on the skin, and water and electrolyte disturbances

  (2) Cushing's syndrome — Hyperfunction of the hormones of the adrenal cortex characterized by weakness, increased blood pressure, excess fat especially in the face ("moon face"), protein loss, osteoporosis, amenorrhea, impotence, and excess hair growth

e. Disorders of the gonads — Hypofunction or hyperfunction of these hormones result in abnormal sexual development (either too much or not enough)

f. Disorders of the Islands of Langerhans

  (1) Diabetes mellitus — Hyposecretion of insulin and lack of metabolism of sugar characterized by elevated blood sugar (hyperglycemia), sugar in urine, excessive urine production, and excess thirst

  (2) Hypoglycemia — Hypersecretion of insulin characterized by deficiency of sugar in the blood

Endocrine System
Unit 14

Student Supplement 1—Identify the Principal Endocrine Glands

Name ______________________________

Directions: Identify the endocrine glands in the following illustration, and place your answers in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

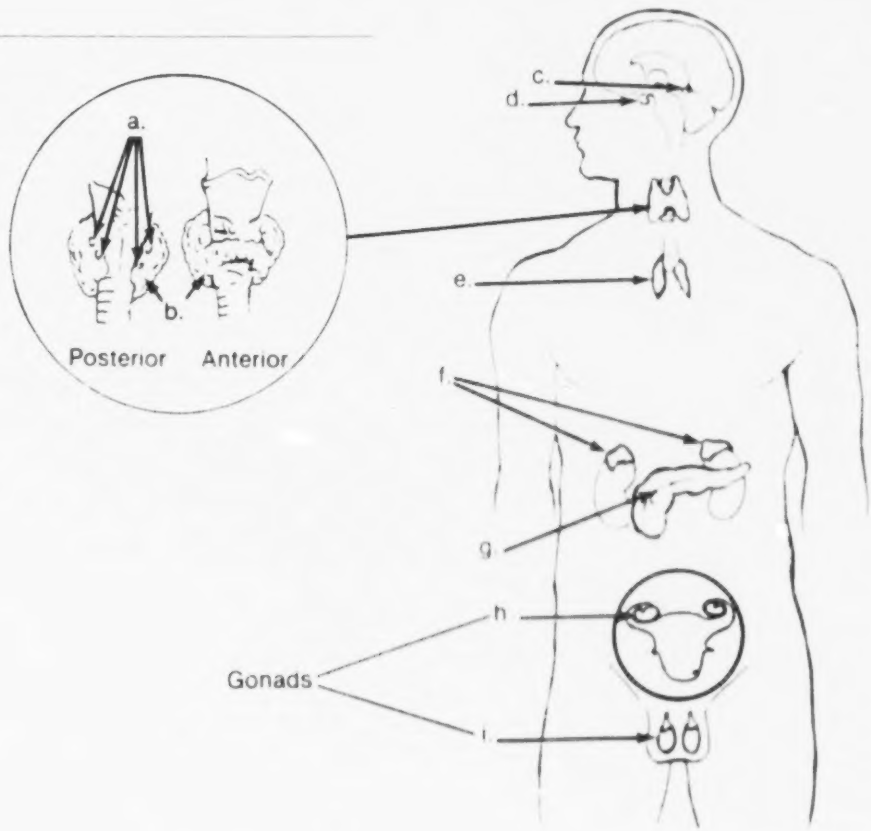
e. ______________________

f. ______________________

g ______________________

h ______________________

i. ______________________


c.
d.
a.
b.
Posterior
Anterior
e.
f.
g
h
Gonads
i.

Endocrine System
Unit 14

Student Supplement 2—Complete a Chart of the Endocrine Glands and Their Hormones

Name ________________________________

Directions: Complete the following chart by writing either the name of the endocrine gland or the name of the hormone secreted.

GLANDS	HORMONES
Pituitary gland	
1. ⓐ ____________________ lobe	Adrenocorticotropic hormone (ACTH) ⓑ ____________________ Somatotropic hormone (STH) Gonadotropic hormones • ⓒ ________________ • ⓓ ________________ • Luteotropic hormone (LTH)
2. Posterior lobe	ⓔ ____________________ ⓕ ____________________
3. Between lobes	ⓖ ____________________
ⓗ ____________________	Thyroxine
Parathyroid glands	ⓘ ____________________
ⓙ ____________________	
1. Cortex	Aldosterone Cortisol and corticosterone ⓚ ____________________ such as testosterone and androsterone ⓛ ____________________ such as estradiol and estrone ⓜ ____________________
2. ⓝ ____________________	Epinephrine (adrenalin) ⓞ ____________________

Student Supplement 2

GLANDS	HORMONES
Gonads 1. ⓟ ______ 2. Ovaries	 Androgens ⓠ ______ Progesterone
Islands of Langerhans	ⓡ ______ Glucagon
Pineal body	Synthesizes ⓢ ______
ⓣ ______	Thymosin
Placenta	Chorionic gonadotropins Estrogens ⓤ ______
Stomach wall	ⓥ ______
ⓦ ______	Secretin

Endocrine System
Unit 14

Student Supplement 3—Complete Statements Concerning the Endocrine System

Name ______________________________

Directions: Complete the following statements or questions by placing the correct answers in the blanks provided.

______ 1. The mineral necessary for the production of thyroxine is

a. Iodine
b. Calcium
c. Iron
d. Phosphorus

______ 2. Hypofunction of the Islands of Langerhans causes

a. Exophthalmic goiter
b. Myxedema
c. Diabetes mellitus
d. Diabetes insipidus

______ 3. The master gland of the endocrine system, located in the cerebrum, is the

a. Thymus
b. Pineal
c. Parathyroid
d. Pituitary

______ 4. Vasopressin is stored in the ______________ lobe of the pituitary gland

a. Lateral
b. Posterior
c. Anterior
d. Sagittal

______ 5. The endocrine gland located in the neck is called the

a. Thymus
b. Pituitary
c. Thyroid
d. Adrenal

Student Supplement 3

_____ 6. A deficiency in the hormone produced by the parathyroid gland will cause

- a. Giantism
- b. Dwarfism
- c. Imbalance of the body's calcium level
- d. Decrease of potassium in the blood

_____ 7. The hormone released by the medulla of the adrenal gland at times of emergency is called

- a. Insulin
- b. Epinephrine or adrenalin
- c. Medullin or adrenalin
- d. The pressor principle

_____ 8. The two hormones secreted by the ovaries are important in the

- a. Development of secondary sex characteristics and normal menstruation
- b. Maintenance of water balance in the body
- c. Regulation of metabolic rate
- d. Transmission of sex-linked genetic traits

_____ 9. Myxedema is a malfunction of which one of the following endocrine glands?

- a. Thyroid
- b. Parathyroid
- c. Adrenal (medulla)
- d. Pituitary (anterior)

_____ 10. Dwarfism is caused by a malfunction of the

- a. Adrenal (medulla) gland
- b. Pituitary (anterior) gland
- c. Pituitary (posterior) gland
- d. Thyroid gland

_____ 11. A goiter is a condition involving the

- a. Parotid glands
- b. Thyroid glands
- c. Parathyroid glands
- d. Adrenal glands

Student Supplement 3

______12. Cretinism is caused by a malfunction of which one of the following endocrine glands?

a. Thyroid gland
b. Pituitary (anterior) gland
c. Pituitary (posterior) gland
d. Parathyroid gland

______13. A hormone secreted by the male sex gland is

a. Estrogen
b. Progesterone
c. Insulin
d. Testosterone

______14. The endocrine glands secrete hormones into

a. Body cavities
b. Ducts
c. The bloodstream
d. The respiratory tract

______15. The hormone secreted by the posterior pituitary gland that stimulates contractions of the muscles of the uterus is

a. Melanocyte
b. ADH
c. Oxytocin
d. Aldosterone

______16. The largest gland in the endocrine system is the

a. Thymus
b. Pituitary gland
c. Thyroid gland
d. Adrenal gland

______17. In the female, the endocrine glands known as gonads are the

a. Fallopian tubes
b. Uterus
c. Ovaries
d. Pituitaries

Student Supplement 3

______18 A ductless gland that decreases in size at puberty is called the

a. Adrenal gland
b. Pituitary gland
c. Thyroid gland
d. Thymus gland

______19. The pituitary gland is considered the most important endocrine gland because

a. Its secretions stimulate other endocrine glands to produce
b. Its secretions control the nervous system
c. It produces so many different secretions
d. Its secretions circulate freely in the bloodstream

______20 The effects of epinephrine include

a. Relaxation of blood vessels
b. Conversion of glycogen to sugar
c. Decreased heartbeat
d. Dilation of bronchi and bronchioles

______21. This temporary organ or gland produces hormones during pregnancy which cause changes in the uterine lining, help to prepare the breasts for lactation, and pregnancy tests are based upon the presence of its secretion. This gland-like organ is the

a. Pineal body
b. Melatonin
c. Placenta
d. Corpus luteum

______22. Vasopressin and oxytocin are stored in the

a. Posterior pituitary
b. Anterior pituitary
c. Parathyroids
d. Placenta

______23. The hormones that function to develop and maintain the female reproductive organs are

a. Testosterones
b. Estrogens and progesterones
c. Coricoids
d. Adrenalin

Student Supplement 3

______24. When the parathyroid glands have been removed or are not functioning properly, the neuromuscular irritability is called

a. Tetanus
b. Lock jaw
c. Tetany
d. Exophthalmic goiter

______25. The testes produce male hormones known as

a. Estrogen
b. Progesterone
c. Testosterone and androsterone
d. Semen